Vol. XVII No. 4

DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1957

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INTRODUCTION

This year *Dissertation Abstracts* will carry, as the 13th issue of Volume XVII, an index to all doctoral dissertations published in the United States and Canada. This issue will be titled *Index to American Doctoral Dissertations*, and will be a continuation of *Doctoral Dissertations Accepted by American Universities*.[1] The joining of these two reference works makes it possible for librarians to have an integrated bibliographical research tool relating to doctoral dissertations under one cover.

Dissertation Abstracts will continue to provide abstracts of dissertations by recipients of doctoral degrees from graduate schools cooperating with University Microfilms in the publication of complete dissertation texts on microfilm, on Microcards, or as microprint. At the end of each abstract will be found an indication of the number of pages in the original typescript and the Library of Congress card number, for the convenience of scholars and research workers. In some instances *Dissertation Abstracts* will be found to be an adequate substitute for the published dissertations.

The *Index to American Doctoral Dissertations* will be a complete indexed listing of dissertations by students who were granted doctoral degrees during the previous academic year, and including those abstracted in *Dissertation Abstracts*, arranged by degree-granting institutions under appropriate subject headings. An alphabetical author index will be included.

The tabular material which has been an established part of its predecessor volume will be included in full, so arranged that statistical summaries can be maintained with no break in continuity.

It is hoped that those who use *Dissertation Abstracts* will continue to make suggestions for its improvement, as these are vital to its continued life and growth. Several suggestions for changes in the headings used for indexing purposes have been received, and a committee of the Association of Research Libraries is reviewing the indexing system at the present time as a result of these suggestions.

[1]Arnold H. Trotier and Marian Harman, (eds.), *Doctoral Dissertations Accepted by American Universities.* (New York: H. W. Wilson Co., 1933-1955.)

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TABLE OF CONTENTS

The Table of Contents lists in alphabetical order the principal subject headings of the dissertations abstracted. For the convenience of readers an alphabetical author index is included following the abstracts.

AGRICULTURE, GENERAL

A STUDY OF THE MODE OF ACTION OF MANGANESE IN THE UTILIZATION OF IRON BY RABBITS AND LAMBS

(Publication No. 20,180)

Robert Hall Hartman, Ph.D.
North Carolina State College, 1956

Supervisor: Gennard Matrone

A study of the interaction between manganese and iron was divided into three parts. Part I dealt with the effect of excessive manganese upon hemoglobin formation in rabbits. Part II consisted of a series of 5 trials (two animals per trial) in which a single dose of radioiron was fed and 4 trials in which the dose of radioiron was injected into rabbits. Part III consisted of two trials on lambs using either oral or intravenous doses of radioiron. In each part two diets were fed, one a control and the other a manganese diet containing 2000 p.p.m. of supplemental manganese.

Manganese supplementation (1) retarded hemoglobin regeneration in anemic rabbits; (2) hindered the absorption of radioiron as revealed by whole blood and hemin time curves, by the radioiron lost in feces and in ingesta and by the concentration of radioiron in the livers; (3) did not affect either the rate of removal of radioiron from the blood or the rate of hemoglobin synthesis as observed from the whole blood, hemin and plasma (lambs) time curves, and (4) increased losses of radioiron from the body in two rabbit injection trials and one lamb injection trial and in the same trials decreased the liver concentration of radioiron. 152 pages. $2.00. Mic 57-1132

LINEAR PROGRAMMING APPROACH TO OPTIMUM RESOURCE USE IN DAIRYING

(Publication No. 19,435)

Milton Moore Snodgrass, Ph.D.
Purdue University, 1956

Major Professor: Charles E. French

The two main objectives of the study were (1) to illustrate the application of linear programming theory to spatial problems as a means of evaluating its usefulness in agricultural interregional trade analysis, and (2) to determine with use of linear programming models, the optimal resource use pattern for movement of products from surplus to deficit areas, location of processing firms, and location of production.

Essentially, the study was one of interregional competition in the dairy industry. The scope included the whole United States. Particular emphasis was placed on transportation relative to patterns of movements of different products, however, location of processing firms and farm production was considered.

The Analytical Technique - Spatial theorists for some time have been attempting to construct a theoretical framework for interregional competition and the specification of a corresponding operational model. Recently, new techniques have been advanced in terms of linear programming theory. This approach to solving spatial problems allows the space factor to be treated explicitly thus the solutions show how distance affects interregional product flows.

The tool used to yield quantitative answers in this study was the transportation model of linear programming. To use the transportation model, data are necessary concerning production, consumption, and transportation. The general problem is: given these data, what is the pattern of movement from surplus to deficit areas that will satisfy all requirements at a minimum cost in the aggregate. To study in addition the optimum location of processing firms and producing farms, costs of processing and production are added to transportation. In addition to yielding optimal patterns of movement and location of production and processing, the solution gives simultaneously, marginal cost values. These are useful in studying the effect of a shift in any manner away from the optimum.

Various factors were introduced into the model. Projections for the year 1965 were made by injecting supply and demand estimates.

Various restrictions in the market structure hindering the free movement of milk were introduced into the model by changing the relative transportation cost structure. The effect of these restrictions was measured by the resulting increase in costs.

The effect of an innovation in the industry which resulted in a new product for consumers was introduced into the model again via the cost structure. The new product - fresh concentrated milk - cuts transportation costs for fluid milk by one third and, of course, adds a processing cost.

The effect of an expanded export program in dairy products was studied. The situation was introduced into the model by increasing consumption requirements of the states from which exports would be shipped. The corresponding increase in production was increased percentagewise in all states. Thus, numerous problems can be molded in the framework of the model.

Summary - The transportation model of linear programming is applicable for the study of optimum resource use patterns within dairying and among regions in the United States. The accuracy of the findings of this study and their subsequent use are limited more by inadequate data than by analytical procedure or the model. Few data were available relative to actual movements of the products. Thus, the degree to which the quanitative answers approximate or deviate from the actual situations could not be adequately assessed. Pertinent descriptive material in some cases gives some help on this problem.

Consumption estimates of dairy products were based on geographic income differentials and income elasticity coefficients which were applicable to a broad interregional study. General transportation rate data applicable to this type of study can be secured. Processing and production cost data are difficult to secure.

The primary contribution made by this study was one of methodology in pointing out how interregional competition problems can be formulated within linear programming theory. A second contribution was in development of data, particularly consumption estimates by states. Third, while generalizations were difficult to make because of lack of evidence, the quantitative answers given by solving the various models gave considerable insight into the nature of interregional competition within the dairy industry in the United States. 253 pages. $3.30. Mic 57-1133

AGRICULTURE, ANIMAL CULTURE

THE INFLUENCE OF DIETARY INEDIBLE ANIMAL FAT, AUREOMYCIN, AND DIETHYLSTILBESTROL ON FATTENING STEERS

(Publication No. 20,476)

Eugene Stanley Erwin, Ph.D.
State College of Washington, 1957

Forty-eight yearling steers were allotted in a 2^4 factorial experiment consisting of 16 groups of three steers each and individually fed twice daily for 183 days. Inedible animal fat, aureomycin, diethylstilbestrol, and roughages (alfalfa and wheat straw) were the variables. Measurements of rate of gain, feed efficiency, and hemoglobin-hematocrit indicated that:

1. Aureomycin significantly increased the rate of gain in steers that consumed either alfalfa or wheat straw.
2. Fat addition to diets increased the rate of gain of steers consuming alfalfa but reduced the rate of gain of straw-fed steers.
3. Diethylstilbestrol feeding showed no significant effect on either the rate of gain or feed required per unit gain by steers.
4. No interaction between aureomycin and diethylstilbestrol was observed.
5. Neither hemoglobin nor hematocrit values were affected by the treatments imposed in this experiment.

Dry matter, crude protein, ether extract, and crude fiber digestion coefficients were determined with steers by the use of the lignin ratio technique. The treatment effects indicated that:

1. Aureomycin significantly decreased the digestibility of ether extract.
2. The addition of seven per cent fat to steer rations significantly reduced the digestibility of dry matter and crude fiber but increased the digestibility of ether extract.
3. Dietary diethylstilbestrol did not influence any digestibility coefficient.
4. A higher digestibility of dry matter occurred in groups fed alfalfa rations but the digestibility of ether extract was higher in straw-fed steers.

All animals were subjected to liver biopsy three times during the experimental period. Measurements of hepatic vitamin A and carotene that were treated statistically to determine the influence of the above treatments indicated that:

1. Feeding fat resulted in a highly significant retention of carotene, but not vitamin A, in the liver regardless of the dietary carotene levels.
2. Neither dietary diethylstilbestrol nor aureomycin influenced the hepatic carotene or vitamin A storage.

89 pages. $2.00. Mic 57-1134

STUDIES ON BLOOD AND MEAT SPOTS IN THE HEN'S EGG

(Publication No. 20,517)

Norman Victor Leonard Helbacka, Ph.D.
University of Minnesota, 1956

A series of experiments were initiated to study the blood and meat spot problem in hens' eggs. The objective was to obtain basic information concerning the physiological, and chemical nature of these inclusions.

Records accumulated on the incidence of blood and meat spots revealed that if these inclusions were recorded accurately by objective means, approximately one-third of the eggs of the dark shelled breeds would be downgraded to C grade eggs because of the presence of blood or meat spots. During the course of this study it was observed that colored meat spots fluoresced red when exposed to ultra-violet light. This property made their differentiation from blood more accurate because blood does not emit any fluorescence. On autopsy, these fluorescent meat spots were found in the uterus and other areas of the oviduct. This red fluorescent material was extracted by chemical means and identified as a porphyrin, the same pigment that is responsible for the color in brown shelled eggs.

The intimate relationship between meat spot color, shell color, and meat spot fluorescence was demonstrated by feeding a coccidiostat (Nicarbazin) which reduced shell color, meat spot color, and the fluorescence of the meat spots simultaneously. A highly significant correlation existed between shell color and meat spot color, shell color and the intensity of the fluorescence of the meat spots, and meat spot color and the intensity of fluorescence of the meat spots. These findings strongly suggested that the shell pigment was responsible for the color of the meat spots.

Blood or hemoglobin derivatives (i.e. hemin) were not found to be a normal constituent of meat spots. A number of fluorescent meat spots and several blood spots were tested for the presence of blood by the benzidine and phenolphthalin tests. All of the meat spots gave a negative test whereas the blood spots in all cases gave a positive test. Histological studies indicated that meat spots are amorphous, with no cellular elements present, including red blood cells.

Quantitative studies on calcium in the meat spots showed that some meat spots contained large amounts of calcium. By means of histochemical staining procedures it was found that this calcium was not localized to any specific areas of the meat spots. X-ray studies of the

meat spots demonstrated X-ray opaque material that was extremely variable in the spots. It was concluded that blood and meat spots are separate entities.

71 pages. $2.00. Mic 57-1135

AGRICULTURE, PLANT CULTURE

COMBINING ABILITY AND RELATED STUDIES OF SELECTED LINES OF RED CLOVER, TRIFOLIUM PRATENSE

(Publication No. 20,508)

Douglas R. Dewey, Ph.D.
University of Minnesota, 1956

Adviser: W. M. Myers

General and specific combining ability for yield of six S_2 and five S_0 lines of red clover were studied by means of diallel single-cross progenies of these lines grown in spaced plantings. Each S_2 line was the self progeny of a single S_1 plant, and each S_0 line was the open-pollination progeny of the same S_1 plant from which the S_2 line was derived. Forage yields were taken twice during the summer of 1955, and an estimated relative yield was recorded at the end of the season.

Marked differences were found among the lines with respect to general combining ability. Five of the 15 single crosses between S_2 lines showed specific combining ability as did four of the 10 S_0 single crosses when determined from total forage yields. Low specific combining ability was observed only in crosses that had at least one parent of low general combining ability.

Inter-progeny yield relationships were studied among the following five progenies: 1. single-cross progeny of eight S_2 lines, 2. open-pollination progeny of the same eight S_2 lines, 3. single-cross progeny of seven S_0 lines, 4. open-pollination progeny of the same seven S_0 lines, 5. the six varieties from which these lines were derived.

No significant associations were observed between yields of any of the progenies at the first forage cut. However, positive correlations of .49 and .74 were found between yields of single-cross and corresponding open-pollination progenies at the second forage cut, the latter being significant. With estimated relative yield data, this same comparison gave correlations of .64 and .84, both of which were significant. In both instances the correlation between S_2 single-cross and open-pollination progeny yields was greater than the correlation between S_0 single-cross and open-pollination progeny yields. The correlation between S_0 and S_2 single-cross progeny yields was of approximately the same magnitude as the correlation between single-cross and open-pollination progeny yields. Yields of S_2 single-cross progenies and yields of the source varieties were not associated at any forage cut.

General combining ability estimates from mean single-cross progeny yields showed good agreement with general combining ability estimates from mean open-pollination progeny yields at the second forage cut and with estimated relative yield. The association of these estimates was poor with first forage cut data.

Vigor of parent S_0 and S_2 lines was estimated on a relative scale from 1 to 5 in 1954, and the mean estimated vigor of a line was correlated with the corresponding single-cross and open-pollination progeny yields of that line the following year. All parent-progeny correlations were non-significant, although a small positive correlation was indicated.

Seedling vigor, as measured on a scale of 1 to 5 under greenhouse conditions, was correlated with forage yields in the field. Seedling vigor was found to be significantly correlated with forage yields at the second cut and with estimated relative yield, the correlations being .34 and .48 respectively. No relationship was observed between seedling vigor and first cut forage yields.

First cut forage yields when correlated with the other two yields gave both positive and negative correlations. Second cut yields and estimated relative yields were associated with a highly significant correlation of .59. The failure of first cut forage yields to be associated with seedling vigor or subsequent forage yields was likely due to establishment differences present at the first cut.

Virus infection, plant type and crown density were all associated with the ability of a plant to overwinter. Virus infection was associated with increased winterkilling and reduced recovery after cutting. Erect plants and those with small, lax crowns failed to over winter. Selection of specific plant types may be useful in improving winterhardiness of red clover. 109 pages. $2.00. Mic 57-1136

INHERITANCE OF PATHOGENICITY IN USTILAGO AVENAE

(Publication No. 20,481)

Philip M. Halisky, Ph.D.
State College of Washington, 1956

This study deals with the inheritance of pathogenicity in Ustilago avenae (Pers.) Rostr., the fungus causing the loose smut disease of cultivated oats. Three races characterized by closely related but well-defined pathogenic reactions were selected for a genetic study of pathogenicity.

The procedure used consisted of isolating haploid monosporidial lines of the fungus with a micromanipulator and propagating them on culture media. These monosporidial lines were then mated to obtain the desired interracial or selfed hybrid progeny for a genetic analysis of pathogenicity.

The experimental results indicate that a given smut spore from a known race may be either homozygous or heterozygous for factors governing pathogenicity. Hybrid progeny from homozygous parents were characterized by 4:0 ratios of strongly-pathogenic to weakly-pathogenic lines. Heterozygous parents, on the other hand, resulted in hybrid progeny that were characterized by 4:0, 3:1, and 2:2 pathogenicity ratios. These ratios were best explained by postulating a genetic system of complementary factors for pathogenicity in this fungus.

The distinct pathogenic reactions characterizing known races of Ustilago avenae are contingent on the expression

of heritable factors. The experimental data indicate that the clear cut differences in pathogenicity between specific races of this fungus are heritable qualities. The genetic basis for these well defined differences in pathogenicity among the parent races was ascertained in this study.

Induced hybridization among selected races of known pathogenicity resulted in the experimental production of a new hybrid strain of the fungus. A comparison of this strain with the race-reaction chart for Ustilago avenae revealed that its pathogenic reaction was unique among the known races. These results indicate that new genotypic combinations governing pathogenicity arise through hybridization among existing known genotypes (races) of the fungus.

The general conclusion is that pathogenicity in Ustilago avenae is a heritable quality governed by the expression of genetic factors. Differences in pathogenicity characterizing specific races of this fungus are contingent on specific differences in the genetic constitutions of these races. The existence of a multiplicity of pathogenic races in Ustilago avenae is indicative of various combinations of genetic factors governing pathogenicity in this fungus.

87 pages. $2.00. Mic 57-1137

ANATOMY

HYPOPHYSIS-ADRENAL SYSTEM IN THE FETAL RAT: AN EXPERIMENTAL STUDY OF THE HYPOPHYSIS

(Publication No. 20,548)

Mona Luyten Coetzee, Ph.D.
University of Minnesota, 1956

Adviser: Lemen J. Wells

Pellets of steroid hormones were implanted subcutaneously in utero 18 days and 18 hours after witnessed mating. Sham implantation was performed. Fetal adrenalectomy was carried out at 19 days and 15 hours. Pregnant mothers were hypophysectomized at 13 days and 12 hours. At autopsy (21 days and 15 hours) the fetal hypophyses were fixed, serially sectioned and stained. Later, the volume of the hypophysis was determined and the histology of the gland was studied.

Morphologically the hypophyses of the female and male fetuses were essentially alike, although the volume of the female gland was usually less than that of the male.

Implanted hydrocortisone retarded the growth of the fetal hypophysis. The characteristics of this retardation were: the volume of the gland was small; the cellular cords were poorly defined; the cytoplasm of the epithelial cells was scanty; some of the nuclei were distorted; mitoses were few; and the vascular sinusoids were small and scarce.

Implanted cortisone produced the same type of histological effects, but the magnitude of the change was less than that caused by hydrocortisone.

Fetal bilateral adrenalectomy induced an enlargement of the fetal hypophysis. The volume was increased, and the sinusoidal and cellular development was enhanced.

Maternal hypophysectomy may have had a slight stimulatory effect upon the developing hypophysis, especially upon the volume of the gland.

Neither implanted nor injected desoxycorticosterone acetate exerted any effect upon the fetal hypophysis.

These observations constitute new evidence for the existence of a functional reciprocal relation between the fetal hypophysis and adrenal cortex.

100 pages. $2.00. Mic 57-1138

ANTHROPOLOGY

THE RAJPUTS OF KHAALAAPUR: A STUDY OF KINSHIP, SOCIAL STRATIFICATION, AND POLITICS

(Publication No 20,410)

John Thayer Hitchcock, Ph.D.
Cornell University, 1956

The dissertation presents an ethnographic study of the Rajput caste of a North Indian village situated between the Jumna and the Ganges rivers, about ninety miles north of Delhi. The Rajputs are landowners and dominate the village numerically, economically, and politically.

The author was resident in the village from November, 1953 to July, 1955, as Field Director of a Cornell University India Project research team. Selections from the ethnographic data on the Rajputs collected from November, 1953 to June, 1956 have been made and analyzed in order to elucidate intracaste developments in politics and leadership. Changes which have occurred during the past fifty years in those aspects of the sub-culture which have been considered for this purpose are also shown.

The Introduction places the village in its ecological and administrative setting and outlines the social structure. Chapter I describes qualities and propensities the Rajputs believe they possess by virtue of caste membership. A relation is made between these beliefs and the history of the caste, and the broadest Rajput kinship divisions are outlined. Chapter II describes the structure and function of two Rajput patrilineal inter-village kin-groups. Chapter III describes the Rajputs of Khaalaapur as a village

kin-group and notes the existence of a tradition of theft, violence and feuding. Chapter IV analyzes socio-cultural aspects of the achievement of a single recent Rajput leader who provided a counter-tradition of reform and comparative harmony within the village kin-group. Chapter V describes the structure and function of two Rajput in-village kin-groups. Chapter VI analyzes the relation between in-village kin-groups and residence; and Chapter VII describes the dynamics of residential division. Chapter VIII presents the structure of intracaste social stratification; and Chapters IX and X, using concepts developed in the preceding chapters, describe Rajput decision-making councils, leading men, factions, and recent political developments, including a present example of outstanding village leadership. 335 pages. $4.30. Mic 57-1139

THE C. L. LEWIS STONE MOUND AND THE STONE MOUND PROBLEM IN EASTERN UNITED STATES PREHISTORY

(Publication No. 19,464)

James H. Kellar, Ph.D.
Indiana University, 1956

The immediate stimulus for undertaking the research was the excavation of the C. L. Lewis Stone Mound in south central Indiana. During the course of its removal it was felt that a sufficient body of data was being assembled to shed some light on the occurrence of possibly analogous structures in the eastern United States and, in order to place the Lewis mound in its proper perspective and attempt an evaluation of earlier and sometimes contradictory statements relative to the significance of so-called stone mounds, an extended compilation of pertinent information was decided upon.

The data pertaining to the construction of burial heaps of stone are not inconsiderable in terms of sheer quantity, but the quality leaves much to be desired. This is as much dependent upon the nature of the sites with their paucity of artifacts as it is on the sketchiness of most of the earlier reports from which a good deal of the information derives.

Although the earlier literature makes many references to the accumulation of stone mounds as a part of historic American Indian burial practices, the archaeological data provide no sufficiently convincing body of evidence that this explanation could account for any great number of the stone mounds reported from the upper Missouri River basin to the Appalachian Mountains. Neither were there good grounds for associating them in quantity with the better known late prehistoric complexes. In general, the bulk of these manifestations are without doubt Woodland and fall well within a prehistoric context.

The central Ohio River Valley, because of a heavy concentration of stone mounds and the fact that there are several which have produced more than the usual amount of material, occupies an important place in the study. One of these, the C. L. Lewis Stone Mound, described in detail, is clearly Adena; but it is exceptional. There is only a minor increment of that complex in the remainder of the material and it is frequently problematical. However, the indications for an early and late use of stone burial tumuli suggests that structural content need not be defintive.

On the other hand, there are in the same area stone tumuli possessing sufficient structural, burial, and artifact similarities to warrant a positive assertion of their relationship. These exhibit traits which align them with Middle Woodland. Other less productive mounds, may be similarly identified. Since Middle Woodland in the adjacent states of Indiana, Ohio, Kentucky, and Pennsylvania is Hopewellian, these stone mounds can be interpreted as a late expression of this important and complex archaeological culture.

There is some basis in the information, particularly in Tennessee, Georgia, and Alabama, for suggesting a degree of relatedness between the Ohio valley and the more eastern and southern stone mounds. Some of the stone tumuli in the Missouri River drainage also appear to have affinities with Middle Woodland. Although the over-all concatenation in these more western sites might appear of the same nature as those to the east, specific trait similarities, except for mound structure and burial forms, are not readily observable. 265 pages. $3.45. Mic 57-1140

ABORIGINAL ECONOMIC SYSTEM OF THE OLYMPIC PENINSULA INDIANS, WESTERN WASHINGTON

(Publication No. 20,398)

Ram Raj Prasad Singh, Ph.D.
University of Washington, 1956

The dissertation summarized here is a study of the aboriginal economy of the Quinault, Quileute, and Makah tribes of the Olympic Peninsula, Western Washington, U.S.A. The descriptive material was derived from my own work in the field, totalling approximately ten months between 1954 and 1955, and published and unpublished ethnographic reports.

Economies of these peoples have been examined critically and an attempt has been made to present the data in a form intelligible to economist and ethnologist alike. This called for an approach somewhat different than that of a standard ethnography or a paper on economic theory. Detail descriptions of resources, production, labor organization, exchange, consumption, and property have been discussed generally in economic terms. The sociological aspects of the culture in question have been treated but reduced to a minimum. However, it is realized that without a general understanding of its social framework the study of an economy will prove sterile. An integrated picture of functional relationships between various aspects of economy has been presented in detail.

Conclusions arrived at are that the economy of simple peoples can be described and understood in terms of economic concepts, such as production, distribution, consumption and the like. Although the economic systems of the Olympic Peninsula Indians were complex, none of their institutions were of the pure economic character. As institutions, they can be analyzed only in terms of social as well as of economic goals. The diversified ecology and differences in accessibility of resources affected the methods of production, labor organization, and forms of distribution and consumption. As a consequence the economic organizations of the three tribes studied were not uniform. Economies of these Indians have been classified on the basis of major exploitation areas as sea economy,

river and coastal economy, and inland economy. This classification should prove a useful concept for the study of Northwest Coast economic systems.

252 pages. $3.25. Mic 57-1141

ARCHAEOLOGICAL STUDIES IN THE VANTAGE REGION OF THE COLUMBIA PLATEAU, NORTHWESTERN AMERICA

(Publication No. 20,400)

Earl Herbert Swanson, Jr., Ph.D.
University of Washington, 1956

The archaeological research incorporated in the thesis is part of a larger program of anthropological research in the Columbia Plateau. The studies in the Vantage region received their impetus from the lack of stratigraphic and chronological information in previous Plateau archaeology. A survey conducted in 1952 had shown that this particular region was likely to supply the necessary information. As a result, expeditions were put in the field in 1953 and 1954.

Cedar Cave, a large rock shelter some 100 feet above the Columbia River, was the focus of attention. The deposits proved to be 15 feet thick, providing natural and cultural stratigraphy, and a record of human events several thousand years long. Several problems were raised by gaps in the human record at this site and by a scarcity of remains at several levels. In an attempt to resolve some of these problems, as well as to round out the picture, excavations of various dimensions were undertaken at eleven other sites.

One of the major problems of Plateau prehistory has been the absence of "index" artifacts. The excavations showed that two ply cordage could be used, locally, for this purpose. Comparison of materials from several sites showed trends and regular changes through time, so that a grouping of several characteristics may be used for denoting broad temporal periods. Whether such changes will be of more than local character remains to be determined. In the Vantage region, these characteristics helped to relate open sites to caves, through cross-dating by stone implements associated with cordage groupings.

Although temporal distinctions could be made, cultural continuity was remarkable, and led to the inference that the prehistoric occupants of the Vantage region were the ancestors of historic Plateau peoples. There are no marked changes or dislocations to suggest otherwise.

The evidence suggests that the prehistoric occupants of the area had a hunting-fishing-gathering economy. Between two climatically dry periods (Altithermal and 1276-1300 A.D. ?), mountain sheep appear to have been intensively hunted. Subsequently, the mountain sheep decline in the record, and there is greater evidence of fishing, especially with nets. It is also about this time that a technically superior cutting implement, the blade, disappears. Adzes appear, differently produced than previously, in greater quantity and diversity. Concomitant with these changes is a shift in housepits from tributary drainages to the main floodplain of the Columbia River. In the earlier location, mussels play an important food role in what is probably a winter settlement; in the later location, they are virtually absent. These changes, and others, presage the development of the historic ethnographic pattern. There is evidence of trade with the Southwest (maize) and with the Pacific Coast (marine shells), and of seasonal movements (storage pits, with food, in small caves). Talus pit burials develop about this time.

A relative archaeological sequence has been recorded, but correlation of other sites in the Plateau has proved difficult. A tentative geological chronology has been essayed, with the earliest human occupation estimated at 14,000 years before the present. This horizon, at the Schaake Site, can not yet be linked with the cave sequence, where habitation began about 8000 to 9000 years ago.

In order properly to reconstruct Plateau prehistory, it will be necessary to examine selected regions more intensively than has heretofore been done. In view of the Vantage region results, it is apparent that the richness of Plateau prehistory has only begun to be appreciated.

380 pages. $4.85. Mic 57-1142

BACTERIOLOGY

STUDIES ON THE IDENTIFICATION, VIRULENCE, AND DISTRIBUTION OF STRAINS OF CHONDROCOCCUS COLUMNARIS ISOLATED FROM FISH IN THE COLUMBIA RIVER SYSTEM

(Publication No. 20,366)

Robert Leroy Anacker, Ph.D.
University of Washington, 1956

Approximately 350 strains of Chondrococcus columnaris have been isolated from salmonids and rough fish from the Columbia River and its tributaries or from lakes or hatcheries in Western Washington during the years 1953, 1954, 1955, and 1956. The incidence of C. columnaris among various species of fish at various stations of the river system has been calculated. Assays of virulence of some of the strains of C. columnaris have been performed.

Three different methods have been used to type strains of C. columnaris. A serological typing scheme has been developed which divides the strains into 4 defined groups and a miscellaneous group. It has been found that some strains of C. columnaris release bacteriocins into a liquid growth medium and that the bacteriocins are lethal for certain other strains. Strains of C. columnaris have been typed on the basis of their response to selected bacteriocins. Several bacteriophages have been isolated which can be used to type certain of the strains of C. columnaris.

145 pages. $2.00. Mic 57-1143

ECOLOGY OF AZOTOBACTER IN PALOUSE SOILS

(Publication No. 20,472)

Guy Richard Anderson, Ph.D.
State College of Washington, 1956

This investigation was designed to increase our information on the location, seasonal occurrence and possible factors influencing the observed distribution of Azotobacter in the Palouse loess; and to test with field experiments some of the ideas previously restricted to pot experiments.

The ecology of Azotobacter in the semi-arid soils of the Palouse loess was examined through field surveys, field plot work and pot studies. The field surveys were conducted largely in Whitman County, Washington and the western half of Latah County, Idaho. Field plot work was confined to the Palouse soils in western Latah County while pot studies included soils from both areas.

Field surveys, extending over a period of three growing seasons, revealed that 47 per cent of 189 soils tested contained Azotobacter. The percentage of Azotobacter positive soils varied considerably at times. This variance was related not only to the total yearly rainfall but to the amount of summer precipitation. The only soils showing Azotobacter populations of 10^3 or more were those soils which remained moist during most of the year. A high moisture retention also seemed to be related to high numbers of Azotobacter in certain soils.

Field plot work revealed that Azotobacter could be established in populations of 10^6 or more per gram in soils once devoid of the organism. It was necessary only to add an energy source such as sucrose and adequate moisture, i.e., one-half inch a week. These populations were maintained without further treatment over winter and survived well into the following summer without any great diminution in number.

Laboratory pot studies correlated well with the field studies. When soil moisture was maintained at 18 to 23 per cent and 1 per cent sucrose added, an artificially inducted soil population maintained itself for months at 10^6 to 10^7 organisms per gram of Palouse soil.

Physical and chemical studies of the Palouse soils, with the exception of moisture retention and pH, revealed no essential difference between soils with large populations of Azotobacter and those without. A higher moisture retention than usual was found in several soils containing large populations of Azotobacter. The pH was observed to influence both the percentage of soils containing Azotobacter and the number of Azotobacter in the soils. However, this effect was not marked. Some soils with pH's of 6.3 maintained an Azotobacter population at 10^2 to 10^3.

The addition of calcium (as limestone), phosphorous, and the minor elements had only slight effects upon the establishment of Azotobacter populations in field studies. Wheat straw, as the normal energy source for microorganisms in the cultivated simi-arid soils, failed to bring about a response in Azotobacter population. This lack of response was noted in both field and laboratory studies.

In potted soils, lime and molybdenum seemed to help maintain high Azotobacter populations once they were established. When suitable sources were not supplied, a high initial Azotobacter population failed to maintain itself and steadily decreased in numbers. Sodium benzoate was not suitable as an energy source supporting Azotobacter development. Lime and other inorganic nutrients had little influence in the absence of an energy source.

Tests for factors in Palouse soils toxic for Azotobacter were completely negative. In fact, concentrated soil extracts were advantageous to Azotobacter growth.

Many bacteria were found which could digest Azotobacter when it was used as a substrate. However, isolates of these organisms failed to inhibit growth of Azotobacter when grown in concert on a medium adequate for both. Molds of the Aspergillus and the Penicillium groups overgrew and limited the growth of Azotobacter colonies. Further, subcultures from such growth to nitrogen free media usually failed to reveal Azotobacter growth. With a static Azotobacter population, Aspergillus and Penicillium may help account for the diminution in numbers often observed.

The factors found to limit Azotobacter growth in the Palouse loess are low moisture, lack of a suitable energy source and pH. 83 pages. $2.00. Mic 57-1144

COMPARATIVE SUSCEPTIBILITY OF VARIOUS SPECIES OF MICE NATIVE TO WASHINGTON TO INOCULATION WITH VIRULENT STRAINS OF PASTEURELLA PESTIS

(Publication No. 20,474)

Marion Bacon, Ph.D.
State College of Washington, 1956

The type of Pasteurella pestis (Lehmann and Neumann) infection which occurs in wild vertebrate hosts other than house rats and house mice has been called "sylvatic" and "campestral" plague, but could be more accurately described by the term "feral" plague. Long persistence of the disease in a given locality is probably effected by a shift of the infection from the epizootic to the enzootic condition. Suggested means by which the pathogen may be kept extant under enzootic conditions are survival of plague bacilli in infected fleas or infested carcasses, maintenance and transmission of the pathogen by non-fatal infections of plague-resistant hosts, and variation in virulence among strains of the pathogen and perhaps change in virulence within an individual strain.

The present study was primarily concerned with investigating the resistance and susceptibility to plague infection of some rodent species indigenous to eastern and central Washington. Available captive rodent specimens totaled 82 deer mice, Peromyscus maniculatus (Wagner), 62 meadow mice, Microtus spp., 12 pocket mice, Perognathus parvus (Peale), one sagebrush vole, Lagurus curtatus pauperrinus (Cooper), one yellow-pine chipmunk, Eutamias amoenus Allen; and one golden-mantled ground squirrel, Citellus lateralis (Say). In eastern and central Washington Peromyscus is common to numerous in all terrestrial mammalian habitats; distribution of Microtus spp. is more erratic, but their populations become congested at certain times and places. Perognathus has an extensive range; it is most common in the driest parts of the state. Lagurus is often very numerous within in its somewhat restricted habitats. P. pestis has been reported from the fleas and tissues of Peromyscus, Microtus and Lagurus, and from the fleas of Perognathus.

The captive rodents were inoculated with graduated dosages of virulent strains of P. pestis isolated from collections made in the field. Surviving animals were sacrificed and tested for the presence of bacteria in the blood, livers and spleens, and for agglutinating antibodies in their sera. Both Microtus and Peromyscus included some plague-resistant and some plague-susceptible individuals. Some individual mice succumbed to dosages of about 10 plague bacilli each, others survived dosages of over 100,000 bacilli. Perognathus seemed entirely susceptible to plague infection. The specimens of Lagurus, Eutamias and Citellus were all susceptible.

Of the animals surviving the tests, 2 out of 23 Microtus and 2 out of 23 Peromyscus showed positive agglutination titers. P. pestis occurred in the tissues of one of the Microtus and two of the Peromyscus; no bacteremias were detected.

Of the animals dead of plague infection, intense bacteremias were found in nearly all of Microtus and in all of Perognathus; bacteremias were generally less intense in Peromyscus, but usually detectable. Pronounced macroscopic abscesses in the livers or other organs were present only in the Lagurus.

The four strains of P. pestis used as inoculum showed differences in their virulences to white mice. All seemed less pathogenic to Microtus and Peromyscus than to white mice. The strain of greatest virulence to white mice was more virulent to Peromyscus than was any one of the other three strains. It probably exceeded any one of the other three strains, also, in overall pathogenicity to Microtus.

Of 10 Peromyscus fed with plague-infested carcasses of white mice, 9 developed fatal plague infections.

It was suggested that Peromyscus and Microtus may be subject to plague epizootics and may also play an important role in maintaining plague in the enzootic condition in eastern and central Washington. Lagurus may play a similar role where present. Perognathus probably cannot long maintain strictly intraspecific plague, but may have enzootic or epizootic importance where other mammal species are present.

Carnivorous and cannibalistic habits may be important means of inter- and intraspecific transfer of plague infection among rodents. 82 pages. $2.00. Mic 57-1145

SEROLOGICAL DIFFERENTIATION OF PHYSIOLOGICAL RACES WITHIN THE CEREAL RUSTS

(Publication No. 20,617)

Arthur Nathaniel Bahn, Ph.D.
The University of Wisconsin, 1957

Supervisors: Professor O. N. Allen, Professor A. J. Riker and Professor J. G. Dickson

Serological and biochemical procedures were used in an attempt to differentiate rapidly between the following physiological races of five species of the cereal rust fungi, namely, Puccinia graminis tritici, races 56, 15B, 38, 11, 17, 49, 32, 139, 49R and 17R, P. rubigo-vera tritici, races 5 and 9, P. coronata, race 45, P. graminis avenae, race 7, 7A and 8, and P. sorghi, clonal cultures 1, 2 and 3.

The urediospore was used exclusively in this investigation. All urediospore material was propagated on susceptible host plants either at the local Department of Plant Pathology or at the Chemical Corps Biological Laboratories, Fort Detrick. Special clonal cultures used in later investigations and propagated from single urediospores, were grown on host plants in the subterranean plant-growing room of the Department of Bacteriology.

The serological tests included the standard precipitin test and a modification of the complement fixation test employing 10 per cent sheep red blood cells. Two types of antigens were used: (a) antigens prepared by homogenizing ungerminated urediospores in physiological saline, and (b) antigens prepared by concentrating the soluble extract of germinated urediospores. Biochemical tests were used to study the effects of dyes on spore germination. The use of dyes as inhibitors of spore germination failed to demonstrate reproducible differentiations between the physiological races studies.

Successful serological differentiation by the use of the complement fixation and precipitin tests appeared to be dependent on the genetic purity of the urediospore collection. Serological characterization of physiological races 56, 15B, 38, 11, 17, 49, 32, 132, 29 and 49R of P. graminis tritici, were made tentatively on the basis of one tube dilution differences. The urediospores of these races comprised a bulk collection and many races were heteogeneous for pathogenicity when tested on a group of wheat varieties. These races were not differentiated specifically but appeared to behave as serological groups rather than serological units. These serological reactions appeared to be correlated with the degree of specificity for pathogenicity of the races.

Clonal cultures of races 56, 15B and 49, P. graminis tritici, isolated on the basis of high specificity on the wheat varieties used as differentials, demonstrated larger serologic differences and greater specificity than did the bulk races 56, 15B and 49. Two races of leaf rust of wheat, P. rubigo-vera tritici, races 5 and 9, were serologically distinct and at the same time showed cross reactivity with each other and the bulk races of P. graminis tritici from wheat. Races 5 and 9 also represented bulk urediospore material. Improved serological differentiations were obtained with races 7, 7A and 8 of P. graminis avenae chiefly with the use of the complement fixation test. A 1 1/2–2 tube dilution difference was observed on the serological comparison of 3 races representative of 3 race groups on the basis of pathogenicity to specific genes for resistance in the host. These races appeared to be nearer homogenous for pathogenicity than the bulk races of stem rust and leaf rust of wheat pathogens.

With the use of antisera for races 7, 7A and 8 of P. graminis avenae four out of five races of this species which had not been previously tested (unknowns) were identified serologically as falling within the correct grouping based on pathogenicity.

In crown rust of oats, P. coronata, only race 45 was studied serologically. While this race was from a bulk collection of urediospores, it was serologically distinct from all other races and species studied. The differences were 1-2 dilution tubes.

Clonal lines and inbred cultures of P. sorghi, corn rust, represented the purest genetic material used in the serological investigation. Cultures 1, 2 and 3 of P. sorghi demonstrated greater antigenicity and higher specificity

as shown by 1-4 tube dilution differences. The three cultures genetically specific for pathogenicity showed large differences serologically.

The proper administration and preparation of the antigens of the fungus was another criterion for successful serological differentiation. The soluble extract antigen of the germinated urediospores demonstrated greater antigenicity and higher specificity than the homogenized antigen. Soluble antigens from germinated urediospores from clonal cultures exhibited greater antigenicity and higher specificity than the soluble antigens from bulk collections of urediospores.

Both proper preparation and administration of the antigens as well as the greater purity of the antigens appear necessary for the successful serological differentiation of the cereal rust fungi. 204 pages. $2.65. Mic 57-1146

STUDIES ON THE LUMINESCENCE OF THE FUNGUS OMPHALIA FLAVIDA AND SOME RELATED ASPECTS OF THE PROBLEM OF BACTERIAL LUMINESCENCE

(Publication No. 20,497)

Milton Joseph Cormier, Ph.D.
The University of Tennessee, 1956

Sodium azide was found to inhibit the bioluminescence of the luminous fungus, Omphalia flavida, in very low concentrations. The inhibition by azide was effective only at acid pH, and was reversed by bringing the pH near the neutral point. The results suggested that hydrazoic acid was the effective agent, and that this compound combines reversibly with fungal luciferin. An apparent phosphorescence, activated by ultra-violet light, was found to be associated with the mycelia of O. flavida. The active material was extracted from the mycelia and partially purified. The spectral energy distributions of the phosphoresence and bioluminescence reactions showed the same emission peak, which suggested that the two reactions are related through the excitation of a common molecular species. During these investigations, a model system for light-stimulated chemiluminescence reactions was found in one of the well known chemiluminescent compounds, 10, 10'-dimethyldiacridylium nitrate. This compound was found to give a relatively bright chemiluminescence when added to certain ultra-violet irradiated alcohols such as isoamyl alcohol or sec-butanol. The light produced was blue, with an emission peak at 450 mu. Quantum efficiency determinations for dodecyl aldehyde, flavin mononucleotide, and reduced diphosphopyridine nucleotide were made using various enzyme preparations from the luminous bacterium, Achromobacter fischeri. From such measurements, it was shown that flavin mononucleotide was not destroyed during luminescence, whereas dodecyl aldehyde was irreversibly utilized during the reaction. In one enzyme preparation, it was found that approximately 0.036 per cent of the reduced diphosphopyridine nucleotide was being utilized for light, whereas the bulk of the compound was being oxidized via another pathway. Flavin mononucleotide and the enzyme luciferase were found to be neceasary for oxidation of the aldehyde in the luminescence reaction. The quantum efficiency data suggested that a peroxidation of dodecyl aldehyde (or of long chain aldehydes in general) furnishes the necessary energy for the excitation of flavin mononucleotide which subsequently leads to light production. 57 pages. $2.00. Mic 57-1147

A STUDY OF THE MODE BY WHICH PENICILLIN STIMULATES THE GROWTH OF RATS

(Publication No. 11,972)

Elliot Colter Dick, Ph.D.
University of Minnesota, 1955

It is well known that the oral administration of antibiotics to the young of certain animal species will increase their rate of growth. Whether these compounds exert their growth stimulating effect through an alteration of the intestinal microflora or by a parenteral action is unknown. The latter possibility was tested by administering, intraperitoneally or per os, magnamycin B or potassium penicillin G to several groups of weanling rats fed a vitamin B_{12}-free diet. It was found that magnamycin B promoted growth only when administered parenterally; penicillin achieved this effect only when given orally. Assays of various tissues for antibiotic activity were negative. Antibiotic activity in the lumen of the alimentary canal was detected only in those portions anterior to the cecum of rats fed penicillin. Both antibiotics altered the intestinal microflora when administered orally but not when injected. The most striking effect was the almost complete elimination of lactobacilli from the cecal contents. Since magnamycin B is a relatively insoluble antibiotic whereas potassium penicillin is highly soluble, one would expect the former to be eliminated from the body at a slower rate than the latter when parenterally administered. The soluble salts of penicillin are known to be eliminated completely within 6 to 8 hours after injection of very large doses. Since the antibiotics were given parenterally once every 48 hours, the animals' tissues were exposed to penicillin for relatively short periods and to magnamycin B for much longer periods of time. Conversely, the tissues of animals ingesting rations containing penicillin were exposed frequently to low levels of penicillin. It is possible, therefore, that the growth stimulation exerted by parenterally administered magnamycin B and by orally administered potassium penicillin G was a consequence of an extra-intestinal effect induced by the prolonged or intermittent presence of small quantities of the antibiotic within the tissues.

The inability to find antibiotic activity in the lower intestines of rats fed penicillin, a finding contrary to previous work utilizing aureomycin and terramycin, led us to test the action of the cecal contents upon potassium penicillin. It was found that the cecal flora did not destroy penicillin unless the organisms were allowed to grow in culture in the presence of the antibiotic. The activity of magnamycin B, however, was not altered by the cecal microflora, even though excellent growth of these organisms was obtained in its presence. These findings suggest that the absence of penicillin from the large intestine was not a result of its inactivation therein, but resulted from its absorption therefrom and/or strong binding to intestinal solids.

Additional studies of pennicillinase were undertaken.

It was found that neither the presence of penicillin in the growth medium nor the degree of oxygenation had much effect upon the production of the enzyme by Micrococcus pyogenes var. aureus. Production of penicillinase was affected but slightly by a drop in pH during incubation of the culture. Studies on the effect of aureomycin in modifying the rate of penicillin inactivation by acetone-dried staphylococci resulted in negative data. A cell-free staphylococcal penicillinase preparation obtained by sonic disintegration was unaffected by dialysis against water and was amenable to partial purification by acid precipitation.

147 pages. $2.00. Mic 57-1148

STUDIES ON THE GROWTH REQUIREMENTS OF A CELLULOLYTIC COCCUS FROM THE BOVINE RUMEN

(Publication No. 20,478)

Donald W. Fletcher, Jr.,
State College of Washington, 1956

The cellulolytic cocci are important cellulolytic agents in the bovine rumen. Preliminary experiments indicated that certain members of this group required rumen fluid for growth or were greatly stimulated by rumen fluid. This investigation was undertaken to establish the growth factor requirements of one of these organisms, including the identification of the essential factor(s) in rumen content.

Growth was proportional to the concentration of clarified rumen liquor added to a complex basal medium containing B-vitamins, purines, pyrimidines, casein hydrolyzate, cellobiose, and mineral salts. A microbiological assay based on this proportionality was developed.

Inability to grow the organism in media commonly used to culture nutritionally fastidious bacteria and in the basal medium supplemented with several feed extracts, suggested that the organism required a growth factor not identical with any previously described. The factor was found only in bovine rumen contents, bovine manure and trypticase (a pancreatic digest of casein).

Potent rumen fluid concentrates prepared by Norite adsorption and elution were analyzed by two chromatographic methods. The growth factor was separated in micor quantities by paper partition chromatography and located on the chromatogram by bioassay. Larger amounts were obtained by chromatography on celite developed with chloroform and n-butanol in chloroform. Two yellow acidic fractions separated by this method support maximum growth at concentrations of 0.62 μeq per 5 ml of the basal medium. The yellow substances are not extracted from chloroform by water but are soluble in dilute sodium hydroxide. The growth factor is soluble in diethyl ether from concentrates extracted at pH 4 but is not extracted from concentrates at pH 8. It is non-volatile with steam but is dialyzable, organic and extremely stable to heat, acid and alkali.

The organism was successfully cultured in a medium containing riboflavin, thiamin, folic acid, cellobiose, a mineral mixture, and 0.5 μeq of the yellow-acidic material resolved by chromatography on celite.

112 pages. $2.00. Mic 57-1149

A STUDY OF STRAINS OF HISTOPLASMA CAPSULATUM

(Publication No. 20,567)

James Edward Greer, Ph.D.
The University of Oklahoma, 1956

Major Professor: Howard W. Larsh

Histoplasma capsulatum is a dimorphic fungus, the etiological agent of a disease, histoplasmosis, of man and animals. The aim of this study was to determine whether the strains of H. capsulatum from animals, soil, and man have recognizable differences such as exist in the genera Microsporum, Mycobacterium, and Brucella. By the use of various diagnostic procedures, it was possible to characterize the fungus further as an aid in its identification and differentiation from other fungi.

Sixty-two strains of H. capsulatum were collected and studied. Of these, 31 were human isolates, 18 were from soil, 6 from dogs, and 2 each from cats, racoons, rats, and skunks. The strains were clinically and geographically representative. The oldest culture was isolated in 1939 and the most recent in 1956. Three of the cultures were from cases in South Africa and the remainder from the United States.

The morphological characteristics of both mycelial and yeast phases of the fungus were observed on a variety of media and microscopic studies were made, but there were no significant differences. No proteolytic activity of any strain on blood, plasma, or coagulated serum was found. Human red blood cells in the agar were not lysed. All strains could utilize di-hydrogen ammonium orthophosphate as a nitrogen source, but none could utilize sodium citrate as a sole carbon source. Glucose and other carbohydrates are satisfactory carbon sources. All strains were found to be catalase positive but oxidase negative. The coagulase tests on both human and rabbit plasma using two human, two soil, and two animal strains were negative. No fluorescence was observed in the cultures of any of the 62 strains at either 2537 A or 2660 A. In addition, 23 cultures of other pathogenic fungi gave no fluorescence although there are numerous reports in the literature to the contrary.[1]

Although urease production has been reported in 17 human strains of H. capsulatum,[2] the method of testing was not given. All 62 strains in this study were found to produce urease in sufficient amounts to give a positive test with urea broth, which is well buffered. In contrast, two strains of Blastomyces dermatitidis, which at times is morphologically indistinguishable, gave positive results with the less buffered urea agar but negative results with urea broth. This provides a means of distinguishing the two fungi.

The viability or survival of H. capsulatum in culture media was observed using 357 subcultures. Desiccated cultures were found to be viable for over three years and moist cultures for more than five years. This is three years longer than any comparable reports in the literature.[3] These data lend support to the current theory that the fungus may maintain itself as a saprophyte or remain dormant in soil and thus serve as a source of infection.

By the means used, the animal, soil, and human strains of H. capsulatum studied were considered to be alike and to belong to one species. 56 pages. $2.00. Mic 57-1150

1. G. M. Lewis and M. S. Hopper. An Introduction to medical mycology. Third Ed., Year Book Publ., Inc., Chicago. pp. 12, 276-277 (1948).
2. A. McLaurin et al., Am. J. Path,, 17, 751-752.
3. G. E. Nielsen and R. E. Evans. J. Bacteriol., 68, 261-264

A STUDY OF THE EFFECT OF SWINE INFLUENZA VIRUS INFECTION OF THE DAM ON PRENATAL AND EARLY POSTNATAL SURVIVAL OF THE OFFSPRING

(Publication No. 20,554)

William Edwin Howell, Ph.D.
University of Minnesota, 1952

Adviser: L. M. Winters

Two hundred and forty-eight female mice of a ZBC x Swiss cross were used in three experiments designed to study the effects of infection during gestation with swine influenza virus on the prenatal and postnatal survival of the litters.

An 0.05 cc. inoculum of a 25 per cent infectious dose of Shope's #15 strain of swine influenza virus was instilled intranasally into the anaesthetized pregnant mice of the first experiment. An ID_{50} was used in the second experiment and an ID_{75} in the third experiment. The mice in each experiment were divided into four lots. One lot in each experiment was used as a control and treated with an intranasal inoculation of 0.05 cc. of diluent only. The mice in a second lot were inoculated with the diluted virus during their fifth day of gestation. A third lot was inoculated on the tenth day of its gestation and the remaining lot on the fifteenth day of gestation.

Each lot of mice in the ID_{25} and ID_{50} experiments was divided into two groups. One group of each lot was sacrificed on the eighteenth day of the gestation in which the mice were inoculated and data were collected to determine the effect of infection at the three stages of gestation on prenatal surviva¹. All of the mice in the ID_{75} experiment were handled this way. The other group in each lot of the ID_{25} and ID_{50} experiments was allowed to whelp its litters and raise them to a weaning age of 21 days. Data were taken from these groups to determine the effect of infection at the three stages of gestation on postnatal survival. These latter groups in the ID_{50} experiment were re-bred for a gestation subsequent to the one in which the mice were inoculated. They were sacrificed on the eighteenth day of this gestation and data taken to determine the duration of the effects of infection with swine influenza on prenatal survival in the mouse.

The following conclusions have been drawn from the results of these experiments:

1. Litter size in the mouse is affected by this viral infection.
2. The greatest effect is registered when the dam is infected during the first trimester of pregnancy.
3. The manifestation of the effect is on prenatal survival, reducing the numbers of fetuses reaching term and hence the numbers born.
4. The preponderance of prenatal deaths beyond natural occurrence in the mice infected during the first trimester of pregnancy is a result of death to a whole litter in utero.
5. The few prenatal deaths in excess of normalcy which do occur in the mice infected furing the second trimester and in those infected during the third trimester of gestation are mainly a result of death to a part of a litter in utero, the rest of which survive.
6. Postnatal survival is not reduced by infection of the dam with swine influenza virus during gestation.
7. There is no residual effect of infection on subsequent prenatal survival in dams infected with an ID_{50} of swine influenza virus.
8. Prenatal mortality increases in rate as the strength of the inoculum is increased.

118 pages. $2.00. Mic 57-1151

FACTORS AFFECTING THE SURVIVAL OF SERRATIA MARCESCENS IN A LABORATORY SPRAY DRYER

(Publication No. 20,636)

Thomas Gleason Morris, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor E. M. Foster

A study was made of the cultural and physical factors which affect the viability of Serratia marcescens during spray drying in a laboratory apparatus with a capacity of about 0.5 ml of feed suspension per minute. A nebulizing device was used to produce droplets which, when dried, had a mean mass diameter of three microns. The droplets were injected into a hot air stream (usually 70 C). the dry particles in the air stream were sampled with a Porton impinger after residence times ranging from 1.6 to 44.0 seconds, and rehydrated in 0.1 per cent peptone water. A turbidimetric method was used to measure the amount of cells collected in the sampler so that the per cent survival could be calculated. This assay procedure could detect differences of one per cent of the cell mass when the number of cells collected was of the order of 50 to 100 millions cells per ml. Viability of the cells was measured by the streak plate procedure.

The atomization and frying processes did not alter the light-scattering ability of cells that were washed and suspended in water before drying. However, cells dried in their growth medium did not give the same degree of turbidity per unit of solids as did the culture before atomization and drying, indicating that some change occurred during atomization and/or drying which affected the light-scattering properties of the cells.

Samples taken before and after atomization indicated that appreciable killing occurred in the nebulizer. However, conclusive results were not obtained because of the difficulty in sampling wet aerosols.

The greatest number of cells were killed during the first two seconds of residence time in the dryer. This was true for cells suspended in water, growth medium, or protective.

The composition of the medium in which S. marcescens was grown affected the ability of the organism to survive.

Cells grown in nutrient broth survived better than did those grown in a synthetic broth containing water, two per cent each of glucose, ammonium sulfate and sodium citrate, and one per cent each of K_2HPO_4, KH_2PO_4, and a mineral salts solution. Better survival of the cells also was obtained when the glucose and ammonium sulfate content of the synthetic medium was increased to four per cent of each. In this medium, S. marcescens produced cells having lengths up to ten microns.

At all temperatures and residence times of drying, addition of two per cent dextrin and one per cent ascorbic acid improved survival of cells grown in synthetic medium. Cells grown in nutrient broth, however, survived no better when suspended in a solution of dextrin and ascorbic acid than when suspended in water. Aeration of the suspension of S. marcescens in the nebulizer before drying improved survival of the cells. The survival of S. marcescens was not affected by variation in the age of the inoculum, temperature of incubation, or the numbers of serial transfers.

Comparison of the laboratory dryer with a pilot scale dryer showed that survivals obtained in the two types of equipment could be correlated, and the laboratory dryer could be used as a means of determining factors which affect survival of cells during the first few seconds of spray drying. 137 pages. $2.00. Mic 57-1152

TAXONOMIC STUDIES ON THE GENUS BACTEROIDES AND SIMILAR FORMS

(Publication No. 20,494)

William Clark Stevens, Ph.D.
Vanderbilt University, 1956

Supervisor: Professor A. P. Harrison, Jr.

The classification of the gram negative, anaerobic, nonsporulating rods is grossly inadequate, due mainly to the failure to subject cultures to critical study with identical tests. With this fault in mind, the present research has been undertaken to characterize broadly a large number of strains with identical tests, in order to provide a basis for describing the group as a whole, to relate the strains with those previously described, and to set up suitable subgroups for purposes of speciation.

For this purpose, 32 strains of gram negative and also irregularly staining, anaerobic rods were procured. The latter were included in the study to see if the gram stain reaction is valid as a basis for establishing taxonomic groups. For comparative purposes, gram positive strain 29-4 of Lactobacillus bifidus also was included in the study. The group included hamster, avian, and human strains; some were isolated by the author, and others were obtained from different laboratories. At least 2 strains were isolated from pathological material.

Characterization of the strains was made on the basis of cultural studies (including colonial structure, oxygen requirements, and temperatures permitting growth), morphology (cell structure and aggregation, gram stain reaction, motility, and acid fastness), extensive fermentation analyses (employing 24 different substrates), miscellaneous tests, mainly of a biochemical nature (including indole and hydrogen sulfide production, catalase production, nitrate reduction, gelatin liquefaction, serum liquefaction, esculin and sodium hippurate hydrolysis, tolerance of 0.1 per cent methylene blue, and survival at 60 C for 30 minutes), analyses of the end products of glucose metabolism, antibiotic sensitivities, and studies of vitamin requirements.

On the basis of these studies, the strains were divided into 3 major groups, employing the characteristics of gas production, catalase production, and gelatin liquefaction. Subgroupings were made on the basis of morphology, fermentation reactions, the amounts and optical types of lactic acid produced, and the range of temperatures permitting growth. Seven species groups were proposed and tentative designations were assigned. No distinct and consistent differences were observed in the gram negative and irregularly staining forms, other than their staining reaction. Consequently, no effort was made to exclude them from the same taxonomic groups.

While not considered to be valuable as a taxonomic tool, the determination of antibiotic sensitivities is significant from a medical point of view. Thirteen strains were tested for sensitivities to terramycin, polymyxin, penicillin, dihydro-streptomycin, chloromycetin, bacitracin, and aureomycin. The sensitivity disk method was employed. The results were variable, but all the strains proved very sensitive to chloromycetin and aureomycin, and most of them proved to be resistant to penicillin and dihydro-streptomycin.

The nutritional studies were indecisive, because the strains proved very fastidious, and they failed to grow in any of the synthetic media employed beyond the first passage. 126 pages. $2.00. Mic 57-1153

BIOLOGY, GENETICS

A COMPARISON OF CROSSING OVER IN POLLEN AND OVULES IN TRANSLOCATIONS INVOLVING THE SHORT ARM OF CHROMOSOME 9 IN MAIZE

(Publication No. 20,507)

Edward Maurice Clark, Ph.D.
University of Minnesota, 1956

Adviser: Charles R. Burnham

This thesis is a study of a phenomenon which had been observed previously in translocation 5-9a. When reciprocal back crosses were made using an F_1 which was heteozygous for the translocation and for genes sh and wx in the short arm of chromosome 9, considerably higher recombination values were obtained when the F_1 was used as the male than when it was used as the female.

For this study, the following groups of translocations were chosen: (A) 5-9 translocations with breaks at different points in the short arm of chromosome 9 and in the long arm of 5; (B) translocations with breaks near .30 in the short arm of 9 and involving some chromosome other than 5; (C) 5-9 translocations with breaks in the long arm of 9 and near .80 in the long arm of 5, and (D) translocations with breaks near .80 in the long arm of 5 and involving some chromosome other than 9. These translocations were selected to find answers to the following questions: (1) Is the phenomenon of a higher recombination in the male for the sh-wx region in a heterozygous translocation peculiar to translocation 5-9a? (2) Does chromosome 5 influence the results? (3) Do other translocations in the long as well as the short arm of chromosome 9 produce similar results?

Pachytene studies of homozygous and heterozygous 5-9a indicated that the break-points were about 9S .40 and 5L .85. These determinations were based on chromomere patterns.

Reciprocal recombination differences were studied in the sh-wx, wx-gl_{15} and pr-v_2 regions. Of the translocations involving chromosome 9, significant differences between male and female for the sh-wx region were obtained for those with break-points between .20 and .46 on 9S. These differences were obtained only for the sh-wx region. Recombination in the male was always higher than in the female. The greatest reciprocal differences were obtained with the translocations whose break-points were at .46 and .40. Smaller differences were observed for those with break-points at .36 and .32, and the differences were barely significant for those with break-points at .27 and .20. The translocations with breaks at 9S .51, .15 and .08 and, with one exception, those with breaks in 9L showed no significant differences between male and female. For the wx-gl_{15} and pr-v_2 regions in these same translocations, there were no significant differences, with a few unexplainable exceptions.

Heterozygous 5-9a was studied further using the marker genes, sh-bz-wx and sh-wx-pr-v_2. Recombination between sh-bz and bz-wx within the sh-wx region showed significantly higher values in the male than in the female for both regions. A four-point study of sh-wx-pr-v_2 showed differences which approached significance in the sh-wx, sh-v_2 and wx-v_2 regions. Recombination in the pr-wx region was significantly higher in the female than in the male. This is the opposite of what was found in other regions.

There was no evidence of differential pollen or ovule viability, or of gametophyte factors. Limited cytological observations revealed no chromosomal abnormalities (knobs, inversions or abnormal 10 chromosomes) which could account for the reciprocal recombination difference.

Length of interstitial segments, chromatids of unequal length formed by crossing over in the interstitial segment and position of the break in chromosome 5 had little relation to the significance of the differences. Only when the break-point was in the short arm of chromosome 9, in the region from about .20 to .46, were there significant differences. 57 pages. $2.00. Mic 57-1154

SOME NUTRITIONAL AND BIOCHEMICAL STUDIES ON SEVEN ADENINE-REQUIRING YEAST MUTANTS

(Publication No. 20,377)

Erik Göran Fägersten, Ph.D.
University of Washington, 1956

Seven purine-requiring mutants of Saccharomyces cerevisiae have been nutritionally and biochemically investigated. Adenine, hypoxanthine and high concentrations of xanthine were the only compounds tested which would satisfy the purine requirement. Guanine showed an inhibitory action.

The ability of high concentrations of 4(5)-formamido-5(4)-imidazolecarboxamide to substitute for adenine was shown to be due to the presence of 4(5)-formamido-5(4)-imidazolecarboxamide as a contaminant. The formamido compound very readily undergoes ring closure to hypoxanthine.

The formation of a pink pigment by one of the mutants was shown to cause an increase in the generation time of the pigmented mutants. The pigment formation could be avoided by adding more adenine to the medium. At a concentration of 40 ug of adenine per ml the growth rate of the mutants was the same.

The frequency of back mutation was determined and it was established that no cross-feeding took place among the mutants.

Some mutants were found to secrete diazotizable amines when grown on limiting adenine. Conditions for maximum production of amines and pigment by resting cells were worked out and adapted for large scale production. Methods for isolation and identification of the two secreted amines were worked out. One was shown to be p-aminobenzoic acid and the other was tentatively identified as 4(5)-aminoimidazole or its ribotide or riboside.

When 4(5)-aminoimidazole was secreted by a mutant the pink pigment was always produced. The relationships between the formation of the pigment and the secretion of the amine have been discussed.

The secretion of p-aminobenzoic acid has been shown to be genetically controlled.

72 pages. $2.00. Mic 57-1155

NATURAL HISTORY STUDIES ON THE STARFISH PISASTER OCHRACEUS (BRANDT, 1835) IN THE MONTEREY BAY AREA

(Publication No. 20,446)

Howard Mitchell Feder, Ph.D.
Stanford University, 1957

The environment, occurrence, food, feeding mechanism, growth rate, reproductive cycle, and predation pressure of the starfish Pisaster ochraceus were investigated near Monterey, California. The relation of physical and environmental factors to distribution of P. ochraceus is discussed, along with observations and experiments indicative of starfish tolerance limits.

Pisaster ochraceus will feed on at least 50 species and is a real or potential predator on most animals living in its habitat. Arthropods and molluscs, especially Mytilus californianus, Balanus glandula, and Tetraclita squamosa rubescens, are eaten most frequently. With some exceptions sedentary and sluggish animals of moderate size are eaten roughly in proportion to their abundance and availability. Methods used by P. ochraceus to secure food vary somewhat according to the nature, size, and responses of the prey. The method of attack on bivalve molluscs is analyzed in detail. Several factors are involved: (1) the starfish can insert its stomach through slits as narrow as 0.2 mm., such as exist in the closed shells of many bivalves; (2) bivalves tend to open their valves voluntarily under water, and appear relatively insensitive to contact with the starfish or its stomach; (3) Pisaster ochraceus can exert pulling forces of at least 4000 grams. Several gastropods show specific escape responses to contact with, or in the presence of Pisaster. The starfish substance eliciting responses in gastropods is associated mainly with the stomach and water vascular system, especially the tube feet.

Living sea stars stained with vital dyes Nile Blue Sulfate and Neutral Red were released in the field and periodically weighed and measured. Wet weight was found to be a more reliable indicator of growth than arm length.

Growth was also followed in starfish kept in aquaria with a surplus of Mytilus, and for five starved controls. Absolute weight gains on the unrestricted diet varied from zero (for certain periods) to 180 grams/month, with weight losses during spawning periods. A 7.9 gram starfish increased its weight by 2850% in 14.7 months, and a 246.0 gram sea star by 395% in 17.3 months. Starved (but healthy) controls sustained a mean weight loss of 35.2% in 18 months.

Animals in the field grew much more slowly than those in the laboratory. Mean weight gains included 38.6 grams (4.9% of body weight) in 11.5 months, in the Mytilus beds, and 29.1 grams (13.1% of body weight) in 10 months in a region dominated by barnacles. The relationship between weight and arm length is discussed. Sea stars of 200 grams may have arms 8-10 cm. long and those of about 1000 grams arms 14-18 cm. long.

In the Mytilus bed studied a mean population of 6.2 starfish/100 sq. ft. consumed a calculated 600 grams of mussel meat/year. Sea stars in the areas studied eat much less than has usually been assumed, and adult mussel mortality is due more to storms than to starfish.

Pisaster spawns once a year in May. Gonad changes in a yearly cycle are described. Development to the early bipinnaria stage is achieved in 4-5 days at 14.8-15.5° C. Larvae raised in the laboratory survived up to 37 days.

Juvenile specimens of Pisaster ochraceus are infrequently encountered intertidally in Monterey Bay. One large population was discovered October 26, 1954 (mean weight 2.4 grams, mean arm length 2.1 cm.). The animals were probably 17 months old and were spawned in May 1953.

310 pages. $4.00. Mic 57-1156

GENETIC INVESTIGATIONS ON CHLAMYDOMONAS EUGAMETOS

(Publication No. 20,447)

Charles Shields Gowans, Ph.D.
Stanford University, 1957

Genetic studies have been made with the unicellular green alga Chlamydomonas eugametos, starting with wild-type stocks originating from F. Moewus.

Thirty-nine nutritional mutants were obtained by a replication technique, following ultraviolet irradiation. These include strains requiring special carbon-sources, nicotinamide, para-aminobenzoic acid, thiamine and purines. Media developed for this work include a minimal medium based on Beijerinck's minerals modified by supplying trace elements in a chelated form and increasing nitrogen, and a complete medium which supplies all common metabolites without inhibiting growth. Twenty-five morphological and physiological mutants were also obtained which are characterized by such features as loss or paralysis of flagella, twinning, altered pigmentation, requirement for high osmotic pressure, and streptomycin resistance.

Studies on crossing-over have been done almost exclusively by means of tetrads. Some 3,000 segregants from over 800 zygotes have been characterized in crosses where from one to five genes were segregating. Equations for computing gene-centromere distances in unordered tetrads have been applied, and eleven gene-centromere distances have been computed. Methods for computing confidence limits of these distances have been worked out. Normal linkage has not been detected, but cases of "negative linkage" (a significant excess of non-parental ditype tetrads) have been obtained, which could have arisen by preferential segregation or by the occurrence of some crossing-over at the two-strand stage. Tetratype frequencies in excess of 2/3 have been found. Apparently the relationship between temperature and crossing-over frequency is not a simple linear one.

Hybrid zygotes from Chlamydomonas eugametos X Chlamydomonas moewusii (from R. A. Lewin) gave good

germination, and the progeny showed recombination for five segregating genes, making doubtful the status of these two as separate species.

In the course of this work no evidence has been found in support of Moewus' report that lower temperatures inhibit crossing-over at the four-strand stage, or that sex determination involves non-allelic genes. Morever, tetratype segregations have been observed for unlinked genes, contrary to Moewus' published data. A detailed critical review of Moewus' genetic work on Chlamydomonas and other algae, with special attention to crossing-over, reveals internal inconsistencies.

109 pages. $2.00. Mic 57-1157

INTERRELATION OF NUCLEIC ACIDS AND ULTRAVIOLET LIGHT INJURY IN ESCHERICHIA COLI AND TETRAHYMENA PYRIFORMIS

(Publication No. 20,454)

Ray M. Iverson, Ph.D.
Stanford University, 1957

There have been two lines of investigation in this study of the relationship of nucleic acids to the ultraviolet light (UV) injury, (1) the effect of UV upon nucleic acid synthesis in the bacterium Escherichia coli B, and (2) the influence of the nucleic acid content of the protozoan Tetrahymena pyriformis W upon the injury produced by UV. The purpose of the first approach was to determine the initial action of UV upon the synthesis of nucleic acids by a cell in various physiological states at the time of irradiation. The second approach designates the probable site of UV-inhibited nucleic acid synthesis.

The results of the first approach showed that deoxyribonucleic acid (DNA) synthesis is stopped immediately after UV irradiation with 254 mμ in logarithmic (log) phase E. coli B cultures, whereas ribonucleic acid (RNA) synthesis continues for about one division cycle before stopping. The synthesis of RNA and DNA in out-of-log phase E. coli B irradiated with wavelengths 254 and 266 mμ is delayed beyond that in the controls, but is not delayed from the controls following UV irradiation with 266 mμ. In all cases the resumption of RNA and DNA synthesis stopped by UV occurs first in the photoreversed (PR) cultures and then in the UV-treated cultures, at about the time when the number of cells begins to increase in the respective cultures.

The second approach used Tetrahymena which during a heat treatment accumulates extra amounts of DNA, deoxyribonucleosides and deoxyribonucleotides, and RNA. The DNA content per cell doubles during heat treatment. It is reduced to the original amount after the first synchronous division following the end of heat treatment (EHT), and this amount remains constant following the second synchronous division. At EHT the cell has double the amount of deoxyribonucleosides and deoxyribonucleotides present prior to heat treatment. This increased amount is maintained following the first synchronous division, but is reduced to the original amount by the second synchronous division. At EHT a Tetrahymena cell has an increased amount of RNA, which is successively reduced by the two synchronous divisions following EHT to the amount present per cell prior to heat treatment.

UV irradiation of Tetrahymena cells in various physiological states as described above gives the following results. The first division, which is delayed more than in the controls, occurs at about the same time in cells irradiated with 226, 254, and 266 mμ before or after heat treatment. The first division is delayed most when cells are irradiated with UV following the first synchronous division.

The second division of Tetrahymena is delayed a progressively longer time when irradiated with 254 and 266 mμ at the following times: immediately after EHT, before heat treatment, and following the first synchronous division after EHT. The second division is equally delayed when cells are irradiated with 226 mμ before or at EHT, but is delayed a longer time when cells are irradiated after the first synchronous division following EHT.

The third division of Tetrahymena cells is reached at the same time when irradiated with 254 and 266 mμ before heat treatment, at EHT, or following the first synchronous division aft EHT. The third division of cells irradiated with 226 mμ is reached at the same time whether irradiated before or at EHT, but is delayed a longer time when cells are irradiated following the first synchronous division after EHT.

These results are interpreted as indicating an inhibition by UV irradiation of the incorporation of deoxyribonucleosides and deoxyribonucleotides into the DNA molecule, although other sites of UV injury are indicated.

103 pages. $2.00. Mic 57-1158

A COMPARISON OF THE PERFORMANCE OF FIRST-CROSS LAMBS FROM WESTERN (COLUMBIA-RAMBOUILLET) EWES AND SIRED BY RAMS OF FOUR DOWN BREEDS

(Publication No. 20,639)

Walter Edward Neville, Jr., Ph.D.
The University of Wisconsin, 1957

Supervisors: Professor A. B. Chapman and
Professor A. L. Pope

The primary objective of this study was to determine whether there were clear-cut differences in economically important traits between crossbred lambs by sires of different Down breeds and out of Western ewes. A secondary objective was to examine weaning weights of the parental straightbreds in relation to those of the cross breds.

The breed of sire differences among crossbred lambs at birth were determined from a two year collection of data at the University of Wisconsin sheep farm. The lambs were firt-crosses which resulted from breeding Suffolk, Hampshire, and Shropshire rams to Western ewes. The characters studied on the lamb at birth were weight, head width, head length and circumference at chine and shoulder points. The characters studied on the dams at parturition were width at hips, width at pins and parturition difficulty which was believed to be due to fetal dystocia.

The breed of sire differences among crossbred and

straightbred lambs at 120 days of age were determined from a two-year collection of data from Wisconsin farms. The crossbred lambs were first-crosses from Western ewes bred to Suffolk, Hampshire, Oxford and Shropshire rams. The 120-day characters studied were live weight, staple length and live grade. The straightbred lambs (purebreds and high grades) were of Suffolk, Hampshire and Shropshire breeds. Four crossbred lambs, two females and two wethers, from the grogeny of each sire were used for carcass studies. The carcass characters studied included carcass weight, cross-sectional length and area of the longissimus dorsi, height of the spinous process of the vertebra, circumference of both thighs and U.S. carcass grade.

Pertinent results were as follows:

Birth characters. Differences in birth weight and in various body parts of the lambs were found to be significantly affected by breed of sire and type of birth. These differences were not found to be associated with dystocia caused by size, body proportion or birth position of the lamb. Differences in birth characters were not found to be affected significantly by the sex of the lamb.

120-day characters. For crossbred lambs, the weighted means were 70.8, 69.9, 65.4 and 63.1 pounds for Suffolk, Hampshire, Oxford and Shropshire sired lambs, respectively. Suffolk and Hampshire crosses weighed significantly more than Shropshire crosses both years. Other breed differences were not significant for both years. Wethers and singles weighed significantly more than females and twins by 2.8 and 9.6 pounds, respectively.

The weights of the straightbreds were arrayed and found to be ranked in the same way as the crossbreds. Very few of the weight differences between the straightbreds and crossbreds were found to be significant within year, sex and type of birth groups. There was, however, a high degree of consistency from group to group in favor of the straightbreds for Suffolks and Hampshires and in favor of the crossbreds for the Shropshires. Three independent estimates of the weight of straightbred Westerns indicated that weights of the crossbreds were midway between those of the parental means.

For live grade, there was no evidence of breed differences which were consistently significant from one year to the next. Singles graded a significant 0.5 of a grade higher than twins.

Carcass characters. Carcass characters were analyzed on the basis of carcasses unadjusted as well as adjusted for weight. Regardless of the adjustment, there was little evidence for significant breed differences for any of the carcass characters. 114 pages. $2.00. Mic 57-1159

TRANSPOSITIONS OF MODULATOR, A MODIFIER OF VARIEGATED PERICARP IN MAIZE

(Publication No. 20,652)

Nancy Worner van Schaik, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor R. A. Brink

Recent work has disclosed a category of genetic elements in maize that, unlike genes, in the classical sense of the word, can undergo transposition from one site to another, independently of other chromosome material. These elements act as modifiers of certain mutational events at other loci. Modulator (Mp) is postulated to be such an element. When Mp is located at the P locus in conjunction with the allele for red pericarp and cob (P^{rr}), it gives rise to the mutable variegated pericarp condition (P^{vv}). Modulator may be liberated from the P locus during a somatic mitosis and become transposed to one or another site elsewhere in the chromosome complement. Such a transposed-Modulator (tr-Mp) in a variegated pericarp plant tends to decrease the frequency of mutation of the P^{vv} allele to P^{rr}, giving rise to the light variegated phenotype.

The present experiment was designed to study the positions tr-Mp occupies in the chromosomal complement after transposition from the P locus as a result of mutation of P^{vv} to P^{rr}. Reciprocal translocations marking all ten chromosomes were used when possible; and linkage between the P locus and tr-Mp was tested in all cases whether or not other markers were present.

Transposed-Modulator was shown to occupy a variety of positions. It was found on Chromosome 1, linked to the P locus in some cases and assorting independently of it in others. Cases also were observed in which tr-Mp showed linkage with reciprocal translocations marking chromosomes 4 and 5, and 5 and 9. It was found, in a series of independently occurring mutations to light variegated, that tr-Mp was linked to P in 64% of cases which obviously is much more often than would be expected if the sites to which the unit moves were distributed at random in the genome. The frequency with which tr-Mp occupies any given position on chromosome 1 increases sharply as the distance from the P locus decreases. Modulator, after being freed from the P locus, often undergoes further transposition. Limited data were obtained suggesting that tr-Mp is less likely to undergo secondary moves if the position first held is close to the P locus. These findings are not inconsistent with the hypothesis that the P^{vv} allele is a compound structure consisting of the P^{rr} gene and Modulator in conjunction with each other at the P locus.

81 pages. $2.00. Mic 57-1160

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

COMPARISON OF FOUR FOREST SAMPLING TECHNIQUES

(Publication No. 19,396)

James Don Barton, Jr., Ph.D.
Purdue University, 1956

Major Professor: Alton A. Lindsey

An investigation of 4 forest ecological sampling techniques was carried out using a 20 acre known natural population of trees over 4 inches dbh from a virgin stand of oak, beech, and maple in southern Indiana. The population was mapped on a scale of 1:36. Each tree was represented by a scaled circle drawn to the nearest 3-inch size class.

The population density is dominated by 3 species, Fagus grandifolia, Quercus alba, and Acer saccharum, each comprising 19-23 per cent. The population basal area is dominated by Quercus alba with 50 per cent. The next highest species is Fagus grandifolia with 8.3 per cent of the basal area. A subtle zonation around the sinkholes was found and it was concluded from early studies by other workers, compared with the results of this study, that this was more apparent earlier in the history of the stand, and that the abundance of Fagus grandifolia, Acer saccharum, and Acer rubrum is increasing in the size classes above 10 inches dbh.

The 4 methods, quadrats of 3 sizes (1/40 acre, 1/10 acre, and 1/5 acre), strips 602 x 25 feet, quadrants, and the variable-radius method were discussed in relation to 2 parameters, density per acre, and basal area per acre.

Per cent standard error as a measure of adequacy was shown to decrease for increasing quadrat size and density except in the case of 0.35 acre strips where the more abundant species were somewhat higher than would be expected from the increase in area. The same relations hold for basal area.

Using per cent standard error as a criterion, sampling was better for density than for basal area by the areal methods, except for the 3 most abundant species by strips. The Bitterlich method sampled basal area better than density.

The number of sample units required for 15 per cent standard error was computed from a formula modified from Lindsey (1955) to utilize the population means instead of the sample means. Number of sample units required for 15 per cent standard error of the mean was combined with 3 other factors, acres required, trees required, and time required, which would make values from all sample units comparable. The last mentioned combination was considered the most important index of "field efficiency". Low values indicate high efficiency. The 4 methods were evaluated in the light of this, and it was found that to sample all 7 of the selected species for density, the order of decreasing field efficiency was: strips, 55; variable-radius, 60; 1/10 acre quadrats, 61; 1/5 acre quadrats, 85; 1/40 acre quadrats, 119.

For basal area determinations, the variable-radius method dominated the other methods with a rating of 13.8. The next lowest rating was 90 for 1/5 acre quadrats. Quadrants (126), 1/10 acre quadrats (145), strips (216), and 1/40 acre quadrats (341) complete the sequence.

Blackman's coefficient of dispersal was computed for all the areal methods. Inconclusive results were obtained except for the most abundant species. Fagus grandifolia and Quercus alba were indicated as having clumped distribution.

The use of the "t" test for bias among species and among methods gave little evidence that bias was present for density or basal area determinations by 1/5 acre quadrats, 1/40 acre quadrats, and the Bitterlich method.

This test was also applied to white oak size class data for small trees (4-13" dbh) and for large trees (22-31" dbh). The mid-point of the larger size class is about 3 times that of the smaller size class. The value of t obtained was 1.2 for the small tree class and 0.4 for the large tree class, little evidence to support bias. The small tree class mean was 89.6 per cent of the true mean, while the large tree class mean was 97.7 per cent of the true mean. The t test was applied to the same data after transformation by the "constant": $\sqrt{X + 0.25}$. The resulting t values were 1.4 and 1.5 for the small and large size classes respectively, again little evidence that bias is present.

121 pages. $2.00. Mic 57-1161

INVESTIGATION OF THE MEHLER REACTION AND RELATED LIGHT DEPENDENT OXYGEN METABOLISM OF CHLOROPLAST PREPARATIONS

(Publication No. 20,511)

Helen Margaret Habermann, Ph.D.
University of Minnesota, 1956

Adviser: Allan H. Brown

Manometric and tracer techniques were used to extend investigations of the parameters of chloroplast systems, to determine the nature of stimulated net rates of oxygen uptake in the Mehler reaction by quinone, ascorbic acid and manganous ions and to study the effects of these substances on related light dependent oxygen metabolism of chloroplast preparations.

Chloroplasts were prepared from mature leaves of Phytolacca decandra L. (common pokeweed).

Maximum stimulation of net oxygen uptake in the Mehler reaction by manganous ions was observed at manganese concentrations above 10^{-4} molar while maximum stimulation by quinone and ascorbic acid was observed when initial concentrations were above 1 to 2 $x10^{-3}$ molar.

Dark equilibration of quinone with chloroplasts resulted in higher rates of both quinone and quinone stimulated Mehler reactions than when quinone was tipped during illumination. There was pronounced inhibition of quinone

reaction rates when quinone or chloroplasts were exposed to incident light intensity of 470 foot-candles before tipping of quinone. Very little stimulation of Mehler rates was observed when quinone was tipped during illumination and maximum stimulation by quinone was obtained only when quinone and chloroplasts were equilibrated in the dark for at least 15 minutes before the beginning of illumination.

Effects on Mehler reaction rates of variation of catalase concentration, chloroplast density, intensity of incident light and oxygen tension were studied. The value of the Michaelis constant for the oxygen reducing enzyme was determined to be 0.046×10^{-3}M. Oxygen tension data indicated that the rate limiting step in the over-all Mehler reaction was not the reaction with molecular oxygen except at substrate concentrations far below the saturating value for the oxygen reducing enzyme.

Detailed studies of the stimulating effects of quinone and ascorbic acid in combination on the Mehler and exchange reactions showed an enhancement of rates of the ascorbic acid reactions by previous reduction of quinone by chloroplasts in both of these systems.

From tracer oxygen experiments it was possible to determine the nature of the stimulation of chloroplast reactions by quinone, ascorbic acid and manganese, ie., whether stimulations were the result of changes in rates of uptake or production of oxygen or changes in both uptake and production. In the quinone stimulation of both the Mehler and exchange reactions uptake and production rates were stimulated equally with no change in the stoichiometry of the reaction. Tracer data indicated that stimulation of net oxygen uptake by addition of ascorbic acid to these reaction systems was the result of competition of ascorbic acid with the normal enzymatic pathway leading to oxygen production for the (OH) product of photolysis causing reduced rates of oxygen production. In all cases there was a concommitant stimulation of oxygen uptake which was interpreted to be the result of the decreased rates of back reaction of the products of photolysis.

Tracer studies of the manganese stimulation of Mehler rates showed that both uptake and production rates were stimulated by the presence of manganous ions, but that stimulation of uptake was approximately twice that of production.

Mödel reaction schemes consistent with the data of tracer oxygen experiments were formulated.

336 pages. $4.30. Mic 57-1162

ORGANIC ACIDS AND GLYCOSIDE BIOSYNTHESIS IN DIGITALIS PURPUREA L.

(Publication No. 20,383)

Sayed Hassan Hilal, Ph.D.
University of Washington, 1956

A study was undertaken to isolate the organic acids present in Digitalis purpurea leaves on the presumption that an organic acid cycle similar to the Krebs tricarboxylic acid cycle might be operating in this plant. An attempt was also made to correlate these organic acids with certain aspects of Digitalis glycoside biosynthesis by the use of excised leaf cultures and isotope tracer techniques.

Organic acids of the mono and dicarboxylic type such as acetic, pyruvic, fumaric, succinic, glycolic and malic were found to be present in Digitalis leaf in such a manner as to suggest the presence of an organic acid cycle similar to the Thunberg-Wieland cycle found in other tissues. Attempts to isolate or identify any tricarboxylic acid were unsuccessful. Carbon-14 from carboxyl-labeled sodium acetate was found to be incorporated in all of the organic acids that will be identified.

Isolation of glycosides from the Digitalis leaves, both fresh and dry, revealed the presence of digitoxin and gitoxin as the chief glycosides under the conditions of each experiment, with indications that more gitoxin than digitoxin was produced. Gitoxin glycoside was observed in crystalline form, but the crystals were very few in number from the small samples of leaf available for extraction. Attempts to isolate these crystals from the adhering impurities were unsuccessful.

Several methods of purification of Digitalis glycosides were attempted by filtration through alumina and Decalso adsorption columns followed by the use of formamide impregnated filter paper technique. Digitoxin, gitoxin and purpurea glycosides were separated in pure spots freed from their adhering impurities. Radioactivity measurements of these chromatographed glycosides showed that no carbon-14 from sodium acetate "feedings" had been incorporated in them.

It was concluded that although an organic acid cycle similar to the Thunberg-Wieland cycle might exist in Digitalis leaf metabolism, there was evidence that steroid glycoside biosynthesis did not directly make use of this cycle and, therefore, acetate from the carboxyl-labeled sodium acetate source was not used as a precursor for the glycoside biosynthesis.

108 pages. $2.00. Mic 57-1163

FACTORS AFFECTING THE GROWTH AND DEVELOPMENT OF MENTHA PIPERITA L. WITH SPECIAL REFERENCE TO THE FORMATION OF ESSENTIAL OIL

(Publication No. 20,411)

Kenneth Jesse Howe, Ph.D.
Cornell University, 1956

The investigation of effects of certain environmental factors on the growth and formation of essential oils of peppermint, Mentha piperita L., was initiated with the hope of elucidating the phenomenon of why mint plants from different regions are so different. From the meteorological data for areas where mint is grown (Midwest: Michigan and Indiana, and Far West: Washington and Oregon) it was determined that light intensity, temperature - especially night temperature, plus the time at which plants could initiate seasonal growth were the most conspicuous factors differing in these areas.

Using nutrient solution culture methods the effects of constant light and temperature were studied in controlled environment rooms. Adaptation of the nutrient culture method to outdoor conditions enabled experiments to be conducted out-of-doors on light intensity and nutrition. Ultimately a combination of the controlled environment rooms and outdoor conditions was used to study the effects

of night temperature, day length, and reduced light. A microdistillation method requiring only a six-leaf sample was developed and subsequently experiments were carried out with respect to the effects on oil content of position of the leaf on the plant, diurnal rhythm, seasonal fluctuations, and different times of initiating seasonal growth,

In the controlled environment rooms it was shown that mint plants are altered morphologically in response to different constant temperatures. Night temperature effects were even more striking. High night temperature rather than low increased oil content. Reducing light intensity or total light on mint plants increas ' the length of the plant in respect to plants under normal light, but there was less oil per plant. In comparison to long-day plants, growth and oil content were drastically reduced when plants were grown under short-day conditions.

Microdistillations on leaves alone showed the oil content of leaves varied considerably in relation to position on the plant. Final conclusions have not been reached concerning fluctuations in oil content in the leaves during the day. Reductions were noted at dawn and dark, but no normal diurnal rhythm was found. Seasonal fluctuation experiments showed a progressive increase in oil content during early growth, reaching a maximum during bud development. Thereafter individual leaves maintained approximately the same oil content throughout the rest of the season.

In all cases where comparable leaves of plants started early in the season were compared to later plants, the early plants contained more oil and a greater number of glands per leaf.

The occurrence, properties, and relation to essential oil formation of a large, fat-staining cellular inclusion were also studied in the leaves of mint. No association of these oil bodies with essential oil formation was established.

The general conclusions are that mint definitely responds to light and temperature in its growth and essential oil formation. The observed high oil content with high night temperatures, contrary to the expected, may be explained as due to higher soil temperatures, offsetting a lower air temperature in the mint regions concerned. Plants starting early in the season formed more nodes, with the two lateral branches and consequently their leaves at each extra node formed. This represents a considerable increase in number of leaves and leaves with a higher gland number than plants started later. One or more of these factors undoubtedly greatly influence quantity differences when mint is grown in different areas, or even in different fields. Nutritional conditions in any case would affect growth and oil content.

There is as yet no scientifically adequate test to measure quality differences in mint oils. These problems of quality differences are discussed in the light of observations made during this investigation.

262 pages. $3.40. Mic 57-1164

A FLORISTIC AND DISTRIBUTIONAL STUDY OF THE MOSSES OF NEW YORK STATE

(Publication No. 20,457)

Edwin Herbert Ketchledge, Ph.D.
Stanford University, 1957

The modern moss flora of New York State consists of at least 416 species distributed among 146 genera and 44 families. Although no species of moss is endemic to New York State, several species are indigenous to the northeastern States. Nearly a quarter of the mosses found in New York are endemic to North America.

Careful analysis of the floristic affinities of the mosses of New York reveals that four distinct floristic elements constitute the modern flora; each element differs from the others in historical development and geographical distribution. The element most abundant in New York in terms of frequency of the component species is the Appalachian element, which includes 181 species, or 43.9% of the flora; these are the dominant mosses of the temperate zone in eastern North America. The element most abundant in terms of taxonomic entities, however, is the Boreal element, embracing 197 species and representing 47.7%of the mosses of New York. Boreal mosses occupy the transcontinental forest formation of boreal North America and range southward into the mountains of the temperate zone. In New York Appalachian mosses are most abundant in the coastal lowlands and rolling uplands, while boreal species occupy the highlands and dominate the flora in mountainous sections of the State.

The remaining two elements are infrequent in New York. The Arctic-Montane element is represented solely by 16 species, 3.9% of the flora, and occurs only on the highest summits of the Adirondack and Catskill Mountains. Similarly, the Subtropical element, with 8 species of 1.9% of the flora, is found only on Long Island and the coastal lowlands. Another 14 species are either cosmopolitan mosses, occurring in all vegetational zones, or are species of uncertain distribution.

The present distribution of mosses in New York State is governed directly by ecological relationships. Although many mosses possess wide ecological amplitude and are frequent within their geographical ranges, many other mosses are limited to particular habitats and thus exhibit specific distributional patterns. In general, the distribution of mosses in New York parallels the distribution of suitable microhabitats.

Historical considerations are primarily responsible for the floristic organization of the mosses of New York. The present flora became established in the State at the close of the Pleistocene epoch but widespread climatic fluctuations in boreal latitudes in recent time have induced latitudinal shifts in regional climaxes and altitudinal adjustments in vegetational zones. The modern flora of northeastern North America is still in the process of achieving an equilibrium following drastic climatic changes in post-Pleistocene time. Because mosses, once established, are capable of surviving in the narrowest of microhabitats, recent fluctuations in climate have led to a high representation of diverse floristic elements in the modern moss flora of New York and a very wide distribution of mosses within the State.

The distribution of floristic elements in the North American moss flora parallels the distribution of related

elements among the flowering plants. Owing to the fact that they are able to persist in very narrow microhabitats, mosses generally are more widespread than their floristic counterparts. In New York the major distributional patterns of mosses approximate the Vegetational Zones of Bray and of House. Treated as floristic elements the distributions of mosses resemble the Vegetational Areas of Shreve.

Viewed in perspective, the modern moss flora of New York State is a continuum, changing in time and space as determined by progressive variations in the environment. The flora, fundamentally, is an integrated assemblage of related entities in dynamic interplay with the environment.

142 pages. $2.00. Mic 57-1165

A PHYTOGEOGRAPHICAL STUDY OF HAWAIIAN HEPATICAE

(Publication No. 20,459)

Harvey Alfred Miller, Ph.D.
Stanford University, 1957

The Hawaiian Islands are a group of true oceanic islands of comparatively recent volcanic origin. The majority of the present flora of Hawaii became established in the course of geological time by way of a series of migrations in which ephemeral islands acted as stepping stones upon which elements present in the modern Hawaiian flora were evolved and selected by chance.

Endemic Hawaiian species of Hepaticae can be grouped into three classes of genera which seem to offer some clue to the relative floristic age, the rate of evolution of species and an index of environmental changes. Genera in the first class contain one or more endemic species and one or more species of both Hawaiian and extra-Hawaiian distribution. Endemic species in class 1 genera (Lepidozia, Calypogeia, Cephalozia, Lophocolea, Jamesoniella, Plagiochila, Diplophyllum, Scapania, Porella, Radula, Pleurozia, Frullania, Cheilolejeunea and Marchantia) are neo-endemics recently evolved in Hawaii.

Genera in the second class contain no extra-Hawaiian species and more than one endemic species, each of which is clearly related to a widespread oceanic species no longer present in Hawaii. These genera (Bazzania, Microlepidozia, Odontoschisma, Cephaloziella, Anastrophyllum, Jungermannia, Nardia, Lopholejeunea, Harpalejeunea, Drepanolejeunea, Lejeunea, Cololejeunea, Pallavicinia, Symphyogyna and Riccardia) represent a more ancient stock than genera in class 1.

Third class genera (Herberta, Herpocladium, Trichocolea, Acromastigum, Tylimanthus, Marchesinia, Trachylejeunea and Asterella) contain but single endemic species which appear to be long isolated types which are remnants of the earliest migrations to Hawaii.

The genera which contain species of both Hawaiian and extra-Hawaiian distribution fall into two groups which offer additional information about the history and derivation of the Hawaiian hepatic flora. The first group is identical to class 1 and shows very strong ties to the southeast Asian-Indomalayan-Oceanic area, with only three species suggesting a recent migration from America. The second group contains the genera Chiloscyphus, Anastrepta, Plectocolea, Notoscyphus, Jubula, Brachiolejeunea, Spruceanthus, Symbiezidium, Archilejeunea, Microlejeunea, Colura, Metzgeria, Wiesnerella, Dumortiera, Plagiochasma, Targionia, Anthoceros, Phaeoceros, Megaceros, Dendroceros and Notothylas, which have no endemic Hawaiian species and represent the most recent arrivals in Hawaii. Nearly all are species known from the southeast Asian-Indomalayan-Oceanic region, indicating that recent as well as ancient migrations have come primarily from that direction.

The hepatic flora of Hawaii contains a random assortment of genera and families which would be expected on an isolated, chance-populated, island group rather than a continental land mass. 140 pages. $2.00. Mic 57-1166

A REVISION OF THE GENUS STYLOSANTHES

(Publication No. 20,758)

Robert H. Mohlenbrock, Jr., Ph.D.
Washington University, 1957

Chairman: Dr. Robert E. Woodson, Jr.

This study is concerned with a revision of the genus Stylosanthes. Stylosanthes is one of the papilionaceous genera of Leguminosae. Although founded by O. Swartz in 1788, one species belonging to the genus was mentioned by Sir Hans Sloane as early as 1696.

The species of Stylosanthes are of relatively little economic importance, although some species are used to a limited extent in an effort to check soil erosion. One species from Africa has several folk uses.

Stylosanthes is closely related to three other genera, Arachis, Zornia, and Chapmannia, but differs from them in the characters of the fruit.

The species of Stylosanthes are found in the eastern United States, Central America, the Antilles, South America, the Galapagos Islands, Africa, India, and Ceylon. The greatest concentration of species is in Venezuela.

The 125 species, subspecies, varieties, and forms which have been ascribed to Stylosanthes have been reduced in this study to 25. Three of these are described for the first time - Stylosanthes hippocampoides from southern South America, Stylosanthes cayennensis from French Guiana, and Stylosanthes figueroae from the vicinity of Cali, Colombia. In addition, Stylosanthes dissitiflora has been reduced to a subspecies of Stylosanthes guyanensis while the epithet for the African species previously known as Stylosanthes mucronata has been changed to fruticosa in accordance with the laws of priority.

The genus is divided into two sections, based on the presence or absence of an axis rudiment (an aborted floral axis), a character limited in the Leguminosae to Stylosanthes. Other characters which prove to be of diagnostic value include the shape and size of the loments.

146 pages. $2.00. Mic 57-1167

SOME EFFECTS OF GRAZING AND FIRE ON VEGETATION IN THE COLUMBIA BASIN REGION, WASHINGTON

(Publication No. 20,486)

James Curtis Moomaw, Ph.D.
State College of Washington, 1957

During 1955 and 1956 a study was made of the effects of fire and grazing on vegetation in the Columbia Basin in central Washington. Comparisons were made across fence- and fire-lines in four habitat types, Agropyron/Poa, Artemisia/Agropyron, Purshia/Agropyron and Purshia/Stipa.

The vegetation was analyzed for species constancy, dominance, and frequency. A 2 x 25 meter macroplot was established in homogenous vegetation on either side of the fence- or fire-line studied and an exclosure was erected to protect the vegetation during the growing season. The herbaceous unions were analyzed by forty, 2 x 5 decimeter plots spaced every half meter along the transect on which cover was estimated according to the Braun-Blanquet system. At each location, volume-weight samples were taken at each end of the transect and a bulk sample of soil was analyzed by decimeter depths for texture, moisture equivalent and pH. During the two seasons, fifty-seven transects were analyzed at twenty-three locations. Three of the sites were analyzed in detail during both seasons.

Each species at a location was classed as increaser, decreaser, invader, or little affected with respect to the disturbance involved.

With respect to grazing, Agropyron spicatum and Festuca idahoensis are decreasers in all habitat types. Bromus tectorum, Artemisia tridentata and Calochortus macrocarpus were found to increase and Sisymbrium altissimum to invade where they occurred. Those species relatively unaffected by disturbance and occurring on all habitat types were Antennaria dimorpha, Arenaria congesta, and Microseris troximoides. All other species respond differently on different habitat types.

The results of this behavior classification were compared with published information and the differences discussed.

With respect to fire, it was found that all shrubby species decreased as did a number of herbaceous plants. Agropyron spicatum and Poa secunda were little affected in any of the habitat types. Bromus tectorum was little affected in the Artemisia/Agropyron type but decreased in the Purshia types. Invaders included Descurainia pinnata var. filipes, Sisymbrium Altissimum, Epilobium paniculatum, and Oenothera andina.

When both grazing and fire were operative, seventeen of the thirty-five species encountered responded differently than they did to these disturbances separately, or they responded differently in different habitat types. The major forage species decreased as they did when subjected to grazing alone, and the shrubby species encountered decreased as they did when subjected to fire alone.

Vigor of grasses was determined by measuring the height of leaves, culms, or of the entire plant, and by counting the number of spikelets or flowering shoots. Vigor of Bromus tectorum was little affected by grazing or burning, but declined in the wetter season of 1956 in all comparisons except one. The vigor of Agropyron spicatum declined in all habitats when grazed, but improved under burning in the Artemisia/Agropyron habitat type. Leaf height of Agropyron increased but culm height and number of culms declined strongly in the second season.

Twenty-five species were collected in 1956 where they had not been seen in 1955. It is believed that the marked increase in precipitation in the early spring of 1956 in part for the appearance of different species, especially in the Purshia/Stipa habitat type, and that the more moist season contributed to the decline in stature of Bromus tectorum and increased vegetative growth of Agropyron spicatum.

Succession in response to fire and grazing, singly, and in combination, are proposed for the Artemisia/Agropyron and the Purshia/Stipa habitat types.

94 pages. $2.00. Mic 57-1168

AN EVALUATION OF SUGAR INVERSION AS AN INDEX OF TEMPERATURE EFFECTS IN FIELD ECOLOGY

(Publication No. 20,487)

Joseph Richard Murdock, Ph.D.
State College of Washington, 1956

A study has been made of the thermochemical method of measuring temperature levels by Pallmann et al. (1940). This method involves the use of sterile solutions of sucrose and a citrate-HCl buffer, which are sealed in ampoules and left to incubate for varying periods in the desired locations. Polarimetric analyses of the solution at the beginning and end of the test period indicates the amount of inversion of the sucrose to glucose and fructose, and this reaction is exponentially related to temperature. An exponential mean temperature is obtained which differs from mean temperatures as measured by methods commonly in use, but which may be considered as having greater physiological significance.

Tests of wide varieties of microhabitats in air, soil and water have shown that despite certain limitations, the method is highly useful for comparing microenvironments in ecological work. 48 pages. $2.00. Mic 57-1169

SOME INTERACTIONS OF THE ENVIRONMENT AND PLANT METABOLISM, WITH SPECIAL REFERENCE TO THE ROLE OF THE KETO ACIDS

(Publication No. 20,425)

Robert Rabson, Ph.D.
Cornell University, 1956

The discovery of such phenomena as photoperiodism, thermoperiodicity and vernalization has emphasized the effects of environmental conditions on plant growth and metabolism. Simultaneously, biochemical research has revealed the existence of certain metabolic pathways in which the keto acids occupy key roles.

These investigations were concerned with the keto acids of plants, their significance, detection and estimation, and also the effect of controlled environmental conditions on these acids and some nitrogenous constituents.

Most of the keto acid determinations in this study followed the procedure outlined by Towers, Thompson and Steward. (J. Am. Chem. Soc. 76: 2392-2396, 1954).

Different plant species were analyzed for their keto acids. Generally, pyruvic, α-ketoglutaric, glyoxylic and oxalo-acetic acids were found in these plants. Furthermore, other unidentified substances, possibly keto acids, were found in some of the plants.

The keto acids of Tulipa gesneriana were reinvestigated. A diurnal variation in the level of γ-methylene, α-ketoglutaric acid apparently exists, the higher levels occurring during daylight and the lower at night.

Previous investigations had revealed that peppermint (Mentha piperita) responded very dramatically to photoperiodic stimulii, and for this reason this plant was selected as an experimental object. Mint plants were grown outdoors in sunlight in water cultures under different photoperiods (8, 12 and 15 hours) and controlled night temperatures (50 and 80° F.).

Major experiments were conducted during three consecutive summers. The keto and amino acids and total and protein nitrogen were analyzed. The following were some of the observations made:

1. Mint stems contain more total keto acid than leaves and much more than roots. The predominant keto acid of the mint plant is α-ketoglutaric acid.

2. Long days and high light intensities favor increased α-ketoglutarate in leaves while low night temperature exerts a sparing action on the concentration of this keto acid. By contrast, short days and high night temperatures are associated with low α-ketoglutaric acid concentrations in the leaves.

3. A diurnal fluctuation in the concentration of the keto acids exists in the leaves and stems. α-Ketoglutarate appears to be synthesized in the light and degraded in the dark.

4. Of the soluble amino acids in mint plants, glutamic and aspartic acids and their amides glutamine and asparagine show the greatest change in response to the treatments.

5. Low night temperature favors the accumulation of glutamine and glutamic acid in leaves, but only glutamine in stems. High night temperature increases the level of γ-aminobutyric acid in stems and causes asparagine to increase relatively to the other amino acids in stems and leaves.

6. Both the protein and total nitrogen of the leaves is increased by low night temperature, while in stems this treatment increases the soluble amino acid nitrogen, particularly glutamine.

7. Long days increase the protein nitrogen in stems.

The results are discussed and integrated into a scheme interpreting the effects of environment in terms of anabolic and catabolic reactions.

In another experiment mint plants were grown for two weeks under the experimental conditions and then exposed to $C^{14}O_2$. The C^{14} labelled soluble amino acids were: aspartic, glutamic and γ-aminobutyric acids, alanine and glutamine. The sugars, glucose, fructose and sucrose were heavily labelled. Numerous unidentified substances were also labelled.

Differences between C^{14} labelling in plants grown under the different environmental conditions were apparent. For instance, sucrose became more highly labelled in leaves of plants grown at low than at high night temperature.

Most protein amino acids were labelled, the more abundantly labelled of which were phenylalanine, alanine and tyrosine.

These findings are interpreted against the background of some earlier work done in this laboratory.

317 pages. $4.10. Mic 57-1170

THE RESPONSE OF ISOLATED STEM SEGMENTS OF SEQUOIA SEMPERVIRENS (LAMB.) ENDL. CULTURED IN VITRO TO VARIOUS CHEMICAL AND OTHER ENVIRONMENTAL TREATMENTS

(Publication No. 20,085)

Donald Francis Restool, Ph.D.
Michigan State University, 1956

Stem segments, one centimeter in length, excised from Sequoia sempervirens burl shoots, were cultured in vitro under the influence of several different environmental conditions.

The basic medium contained Knop's Solution, Berthelot's Solution, three percent sucrose, two percent agar, naphthaleneacetic acid at several levels of concentration, and a number of growth supplementary substances: cysteine, certain B vitamins, ascorbic acid, and in one case, yeast extract.

The addition of three percent yeast extract to the medium along with the supplementary substances resulted in an initial inhibition of growth as well as the killing of some segments. Later, growth was greatly enhanced among the surviving cultures by these substances. At this time, the supplementary substances were more beneficial for the production of fresh weight in darkness than in light. An inhibition of buds occurred in darkness in the presence of the supplements. Yeast extract was omitted thereafter from the basic medium because it furnished unknown constituents to a medium of otherwise known chemical composition.

Naphthaleneacetic acid, at 100 gammas per liter, reduced and sometimes completely inhibited the initiation of buds.

The differentiation and growth of roots occurred in the absence of naphthaleneacetic acid but did not occur in the presence of 50 and 100 gammas per liter. Shoots grew vigorously in the absence of roots.

Maleic hydrazide inhibited all growth of the segments at 10, 100, and 1000 parts per million. No observable differences in growth or bud formation occurred between cultures with and without one part per million of maleic hydrazide.

The original position of the segment on the shoot and the original weight of the segment at the start of the experiment had no effect upon subsequent growth.

Room temperature (about 21°C.) provided a suitable, but not an optimum, temperature for the growth of segments. A controlled temperature of 24°C. allowed better growth than 30°C. At 6°C. buds developed slowly but normally. Buds were formed at 37°C. but they failed to develop and reverted to callus.

The reduction of aeration caused by the submersion of the segments resulted in a complete inhibition of buds and a reduction in the amount of callus produced; the controls,

receiving normal aeration, produced numerous buds and a large amount of callus.

Adenine sulfate at 40, 80, and 120 milligrams per liter inhibited bud initiation and fresh weight production by the segments. The inhibition of buds and of fresh weight by adenine sulfate was partially alleviated by the presence of increasing concentrations of naphthaleneacetic acid at 50 and 100 gammas per liter.

119 pages. $2.00. Mic 57-1171

STUDIES ON THE PATHOGENICITY AND HOST RANGE OF THE SUGAR BEET BLACK ROOT FUNGUS, APHANDOMYCES COCHLIOIDES DRECHS.

(Publication No. 19,228)

Charles Louis Schneider, Ph.D.
University of Minnesota, 1956

Adviser: J. J. Christensen

Studies were made on the nature of parasitism of Aphanomyces cochlioides including the nature of infection, the host range, physiologic specialization and survival of the pathogen in relation to cropping sequences.

Zoospores were found to be the most suitable type of inoculum of A. cochlioides for inoculating seedlings of sugar beets in the greenhouse. They are readily obtained in large quantities from mycelial mats submerged in sterile tap water at 20°C. and can be applied in controlled amounts to the soil before or after emergence of seedlings.

The relative susceptibility of sugar beet strains to A. cochlioides was best determined when approximately 100,000 zoospores in aqueous suspension were applied to each 4-inch pot of seedlings about 15 days after planting in autoclaved soil. Greenhouse inoculation tests were effective in screening out the most susceptible strains but did not precisely differentiate among the resistant ones.

Mass inoculation of seedlings of sugar beet in field plots was accomplished by mechanical application of oat grains, infested with A. cochlioides in the drill row at planting.

A survey was made of the host range of A. cochlioides, wherein 94 plant species representing 31 families were inoculated with the fungus in the laboratory and greenhouse. Thirty species included in the following families became infected: Aizoaceae, Amaranthaceae, Chenopodiaceae, Hydrophyllaceae, Papaveraceae, Portulacaceae and Solanaceae. The pathogen was isolated from 18 of these 30 species grown in naturally infested field soil. The following weeds became infected in the seedling stage and when the plants were about two weeks old: Chenopodium album, Amaranthus blitoides, Salsola kali and Saponaria officinalis. Lychnis alba and Portulaca oleracea became infected in the seedling stage only.

In tests in the greenhouse and field, differences in relative susceptibility to A. cochlioides among varieties of garden beets, mangels, and chard were shown. None were immune or more resistant than sugar beet varieties developed for black root resistance. Mangels as a group were highly susceptible to tap root rot caused by A. cochlioides.

Over 40 single spore isolates of A. cochlioides from Michigan, Minnesota, Montana and Ohio were studied in relation to physiologic specialization. All isolates produced oospores on corn meal agar and produced zoospores when mycelial mats were submerged in sterile tap water. Differences in rate of growth on potato dextrose agar were consistently noted among the isolates. Some isolates differed in rate of growth at 15, 20 and 25°C., whereas others differed only at 25°C.

Single spore isolates from spinach, New Zealand spinach, bouncing Bet and lamb's quarters caused damping off and typical symptoms of black root on sugar beets. Likewise, single-spore isolates from sugar beets were pathogenic on seedlings of each of the above hosts.

All single-spore isolates were pathogenic on several varieties of sugar beets, mangels, spinach, garden pink, Kochia and white cockle. Minor differences in virulence among the isolates were noted on the respective hosts. There were also differences among the isolates in their ability to cause rot of tap roots of sugar beets.

107 pages. $2.00. Mic 57-1172

SOIL CHARACTERISTICS IN RELATION TO CERTAIN FOREST TYPES IN THE NORTHERN ROCKIES

(Publication No. 20,488)

Jack Behrent Secor, Ph.D.
State College of Washington, 1956

An investigation was made of the soil-plant relationships in four habitat types of the Picea engelmanni/Abies lasiocarpa (spruce/fir) zone in the mountains of northern Idaho. These habitat types are as follows:

Spruce-Fir/Xerophyllum (SF/X)

Spruce-Fir/Menziesia (SF/M)

Spruce-Fir/Xerophyllum-Pachistima (SF/X-P)

Spruce-Fir/Menziesia-Pachistima (SF/M-P)

The SF/X and SF/X-P habitats occur on the drier south-facing slopes, with the SF/M and SF/M-P types at comparable elevations on northern exposures. These habitat types were studied in three areas (Kaniksu, St. Joe, and Nezperce) which form a general north-south transect and extend from Bonner County into Idaho County, Idaho.

Vegetational analyses indicate that those habitat types at lower elevations containing the Pachistima union (SF/X-P and SF/M-P) have the greater diversity with respect to their vascular flora. Most of the herbs and shrubs characterizing this union disappear in the SF/X and SF/M sites occurring at higher elevations.

The soils, for the most part, appear to fit the general descriptions of Brown Podzolics. The soils of three of the habitat types (SF/M, SF/M-P, and SF/X-P) possess a thin, interrupted A_2 which is grayish in color, with a yellowish-brown B_2 horizon directly beneath. The SF/X habitat, possibly due to the extensive fibrous root system of Xerophyllum tenax, exhibits a general $A_3(-B_1)-B_2$ horizon sequence, with an horizon break on the basis of color and texture. All profiles are shallow and rocky, seldom having a solum more than two feet deep. An apparent decrease in the podzolization process as one goes from north

to south is discussed with reference to possible climatic differences in the study areas.

Soil reaction values for the profiles indicate that they are acid, generally with a pH of between 4 and 6. Surface sample collections show that SF/X and SF/M habitats are more acid than SF/X-P and SF/M-P sites, and the possible relation of this difference to certain edaphic and physiologic factors was suggested as being influential in controlling the distribution of Pachistima union species.

Profiles on south-facing slopes (SF/X and SF/X-P habitats) in the Kaniksu area were found to possess higher organic matter and nitrogen than those on north-facing slopes (SF/M and SF/M-P). The possible reasons for higher organic matter content of certain soils on south-facing slopes are discussed with reference to (1) the possible former presence of an herbaceous flora on these slopes during the post-glacial xerothermic period, (2) a successional history implicating fires on these more xeric sites, (3) the advantages (for plant growth) of light and warmer temperatures on these slopes, and (4) the possible influence of Xerophyllum tenax in increasing and maintaining the humus content of these soils.

Divalent cations (calcium and magnesium) were generally found to be the only metallic cations present in any abundance on the exchange complex.

Volcanic ash studies of these profiles indicate that this material is present in all profiles, in some cases in very large amounts (50 per cent of the very fine sand fraction). These findings are discussed in connection with possible centers of origin and depositional periods of this material.

The clay mineralogy of certain Kaniksu soils indicated the presence of kaolinite and mica intermediates, with gibbsite, quartz, and feldspars also being identified. Evidence for the possible accumulation of aluminum by certain plants is presented, and several ecologic and physiologic implications of aluminum accumulation have been discussed in detail.

175 pages. $2.30. Mic 57-1173

CHEMISTRY, GENERAL

SPECTROPHOTOMETRIC STUDIES OF CHELATES OF 8-HYDROXYQUINOLINE IN SOME WATER MISCIBLE SOLVENTS

(Publication No. 20,370)

Walter Gordon Boyle Jr., Ph.D.
University of Washington, 1956

The reactions of the nitrates of copper(II), zinc(II), cadmium(II), nickel(II), lead(II), and uranyl ions with 8-hydroxyquinoline in a dioxane, n-propyl alcohol mixed solvent and in dimethylformamide have been investigated to determine whether the soluble chelates formed in the two solvent systems would be suitable for the analysis of these ions by means of photometric titrations.

By comparing the results of spectra and photometric titrations it was found that the addition of base to the solvents enhanced the reactions of the cations with 8-hydroxyquinoline and that in the case of copper and zinc the reactions were quite suitable for photometric titrations, giving standard deviations of about one to two parts per thousand respectively. With cadmium(II), lead(II), and uranyl ion evidence of a third molecule of oxine entering the reactions was discovered. With nickel(II) ion evidence of three to one chelation of 8-hydroxyquinoline to nickel ion was discovered.

In order to gain highly sensitive photometric titrations which would take full advantage of this method, a high absorbance reference procedure was used and a dilution correction formula proposed which gives a more correct representation of the process and allowed dilute solutions to be titrated more accurately.

The results indicated that much useful information can be contributed to the field of analytical chemistry by photometric titrations in this type of system.

69 pages. $2.00. Mic 57-1174

CHEMISTRY, BIOLOGICAL

PART I: HYDRAZINE AS AN INTERMEDIATE IN NITROGEN FIXATION. PART II: THE NATURE AND ROLE OF PHOTOSYNTHETIC PRODUCTS ON NITROGEN FIXATION BY SOYBEAN NODULES.

(Publication No. 20,616)

Michael Klaus Bach, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Robert H. Burris

Hydrazine at concentrations of 10^{-4} to 10^{-5}M disappeared from dense, washed suspensions of Azotobacter vinelandii cells in phosphate buffer at pH 6.8. The disappearance of hydrazine was caused only by live cells, was stimulated by the addition of potassium cyanide and acetaldehyde, and was inhibited by the addition of ammonium sulfate. Catalase had no effect on the reaction, and preformed hydrogen peroxide in the suspension accounted for no more than 1% of the hydrazine which disappeared.

When hydrazine labeled with N^{15} was supplied to the cells, N^{15} labeled molecular nitrogen and free ammonia were recovered. Between 60 and 90% of the hydrazine that disappeared could be recovered in the form of dihydropyridazinone-5-carboxylic acid (PCA) and two other products which are formed in the chemical reaction between α-ketoglutaric acid and hydrazine.

The increased rate of disappearance of hydrazine in the presence of added potassium cyanide and acetaldehyde probably resulted from enhanced production of hydrogen peroxide by the cells, and the inhibited rate with ammonium sulfate can be attributed logically to competition between ammonia and hydrazine for the limited supply of α-ketoglutarate.

PCA is formed in very dilute aqueous solutions of α-ketoglutarate and hydrazine without the mediation of biological agents. Its formation is optimal at pH 5.5. Aqueous solutions of the compound are stable for several weeks at room temperature. Solutions of PCA exhibit a strong absorption maximum in the ultraviolet between 250 and 260 mμ.

By the application of ion exchange methods and paper chromatography, PCA was shown to occur in A. vinelandii cells grown on a nitrogen-free medium as well as in nodules from field-grown soybean plants. Preliminary evidence from experiments with N^{15} labeled molecular nitrogen implicated PCA as an intermediate in biological nitrogen fixation. The level of N^{15} in PCA was equal to or higher than the levels in the previously accepted first products of fixation (ammonia and glutamic acid). In addition, Azotobacter cells supplied N^{15} labeled ammonia did not show any significant incorporation of N^{15} into PCA.

The second section of this thesis concerned the C^{14} labeled compounds which were found in the roots and nodules of soybean plants after the whole plants had been exposed to radioactive carbon dioxide. The sugars, and particularly sucrose, showed a high level of C^{14}; their radioactivity did not change significantly when the plants were allowed to respire normally for a ten hour dark period following the ten hour light period allowed the controls.

The organic acids followed the sugars in their level of radioactivity. A marked shift in the relative amount of C^{14} in the organic acid fraction occurred in the nodules between the light and dark periods, for this fraction contained only 8% of the total C^{14} in the nodules of the plants harvested at the end of the light period in contrast to 20% at the end of the dark period. No comparable change was observed in the roots. Several unidentified organic acids were encountered, and some of these contained considerable portions of the total organic acids of the cells.

The changes in the C^{14} of the amino acids in the nodules

were the reverse of those of the organic acids; 15% of the total C^{14} was present at the end of the light period and 7% at the end of the dark period. No change was observed in the relative amount of acidic amino acids in the total amino acid fraction.

The addition of sugars to sliced, excised soybean root nodules stimulated their fixation of N^{15} labeled molecular nitrogen by as much as 50%. The stimulation was apparent throughout the course of the experiments rather than only late in the experiments when depletion of the endogenous supply of carbohydrate would be anticipated. The optimal concentration of carbohydrates to effect the stimulation was between one and 2 x 10^{-2} M. Borate did not enhance the stimulation caused by sucrose. Fructose stimulated fixation of nitrogen most effectively, followed by sucrose and glucose. 136 pages. $2.00. Mic 57-1175

METHODS FOR THE DETERMINATION OF TRIHYDROXY AND DIHYDROXY CHOLANIC ACIDS IN BLOOD SERUM AND FECES WITH OBSERVATIONS ON THE ALTERATIONS IN SERUM BILE ACID CONCENTRATIONS IN CERTAIN TYPES OF HEPATOBILIARY DISORDERS

(Publication No. 20,543)

James Bain Carey, Jr., Ph.D.
University of Minnesota, 1956

The literature concerning certain historical, chemical and metabolic aspects pertinent to the thesis subject is discussed in the initial sections. The experimental work includes a description of the isolation and identification of deoxycholic acid from normal human feces and two simplified procedures suitable for studying larger numbers of subjects. The latter utilizes the ultraviolet absorption spectra for quantitation of bile acids in properly prepared extracts of feces.

An antimony trichloride reagent is described for use on paper chromatograms which gives a distinctive fluorescence with each of nine bile acids studied including the isomers, chenodeoxycholic and deoxycholic acid.

Chenodeoxycholic acid was the chief dihydroxy bile acid in extracts of normal human serum chromatographed on paper. Cholic acid and deoxycholic acid were also demonstrated in normal human serum in this manner. The bile acids were present in serum as conjugates of glycine and taurine.

A semi quantitative, differential method for the determination of trihydroxy and dihydroxy bile acids in serum was developed. Serum was extracted with alcohol containing BaOH, lipids were removed with a petroleum ether ethyl ether mixture and following hydrolysis, the bile acids were measured at their appropriate ultraviolet absorption maxima in 65 per cent sulfuric acid.

By this method, the normal value found for trihydroxy acids was 14.4 μg. per ml. The estimated error for the method was 1.7 μg. The standard deviation for the population was 3.2. The normal dihydroxy value was 4.3 μg. per ml. with an estimated error of 0.7 μg. and a standard deviation for the population of 0.5. The average trihydroxy-dihydroxy ratio was 3.4 with a standard deviation of 0.54.

One hundred and seventy fractional determinations of serum bile acids were made in a group of 100 patients, most of whom were jaundiced, and in these the following observations were made: 1) with severe liver injury a disproportionate increase in dihydroxy acid concentrations causes the trihydroxy-dihydroxy ratio to be less than one. 2) Persistence of this reversed ratio is usually followed by coma, death or both. When the ratio is only temporarily reversed, improvement or recovery of the patient is paralleled by an increasing ratio to values greater than one. 3) With intrahepatic cholangiolar disturbances or extrahepatic biliary obstruction, bile acid concentrations are increased but the ratio remains normal.
229 pages. $3.00. Mic 57-1176

A STUDY OF MOSS OXALIC ACID OXIDASE

(Publication No. 20,375)

Prasanta Kumar Datta, Ph.D.
University of Washington, 1956

The oxidation of oxalic acid by plants has been known for a long time. Zaleski and Reinhard first demonstrated in 1911, that oxalic acid can be decomposed by wheat bran with the production of CO_2. After the discovery of oxalic acid oxidase in mosses by Houget and his collaborators in 1927, the enzyme has been studied by several people in somewhat greater detail. The present paper reports the results of our recent investigations on oxalic acid oxidase obtained from about a dozen species of moss collected in the state of Washington.

Oxidation of oxalic acid by this enzyme proceeds according to the following equations:

$$(COOH)_2 + O_2 \longrightarrow 2\ CO_2 + H_2O_2 \text{ (oxalic oxidase)} \quad \ldots (1)$$

$$H_2O_2 \longrightarrow H_2O + \tfrac{1}{2} O_2 \quad \text{(catalase)} \quad \ldots (2)$$

overall reaction:

$$(COOH)_2 + \tfrac{1}{2} O_2 \longrightarrow 2\ CO_2 + H_2O \quad \ldots (3)$$

The respiratory quotient (R.Q.) of equation (1) is 2 and that of equation (3) is 4. The proof for the correctness of this reaction scheme has been presented by measuring the R.Q.s of the two reactions (equations (1) and (3)), using on the one hand a catalase-free enzyme and on the other a catalase-free enzyme combined with crystalline beef liver catalase.

It has been demonstrated that, contrary to Franke et al., moss oxalic acid oxidase is a flavoprotein, the active group being riboflavin or riboflavin phosphate (flavin mononucleotide) and not flavin adenine dinucleotide. Which of the two flavin compounds (riboflavin or riboflavin phosphate) is the "true" active group has not been decided; equimolecular concentrations of riboflavin and riboflavin phosphate, in the concentration range of 1.0 to 6.6 x 10^{-6} M, stimulated the apo-enzyme fraction to the same degree, even in a phosphate-free reaction system which makes phosphorylation of riboflavin impossible prior to the coupling with the apo-enzyme. Moreover, the addition of arsenate which inhibits phosphorylation competitively, did not have any effect on the activation of the apo-enzyme by riboflavin. Atabrine (10^{-3} M) did not act as a competitive inhibitor either.

The pH optimum has been found to lie between pH 2.5 and 4.5, depending on the species of the moss studied and on the pre-treatment of the moss.

This oxidase is extremely thermostable and about 75% of the activity of the control can be recovered after exposing the apo-enzyme fraction to a temperature of 75°C for 60 minutes. The enzyme is also sensitive in its oxygen requirement and under the experimental conditions an O_2 tension corresponding with 20% O_2 could saturate the reacting system. Lower values of O_2 tensions were found to reduce the oxalate oxidation.

Moss oxalic acid oxidase is not only very substrate-specific but it also has a rather high affinity for its substrate, oxalic acid. A "Ks" value of limited theoretical significance was calculated for a pH 4.0 and a temperature of 20°C and was found to be 3×10^{-6}M.

This enzyme is cyanide insensitive. About 50% inhibition was induced by metal ions such as Cu^{++} and Mn^{++} at a concentration of 3×10^{-3}M. A 10^{-2}M solution of KI inhibited the oxidation reaction by about 80 to 90%. The presence of inhibiting cations in aqueous moss extracts has been demonstrated. EDTA (10^{-2}M) stimulated the oxalate oxidation.

Reduced glutathione and cysteine did not have any stimulating effect on the oxidation of oxalic acid by this enzyme.

The intracellular locale of this enzyme is not clearly understood. It has been tentatively assumed that the oxidase in moss is associated with the chloroplasts and not with the nonchloroplastic cytoplasmic constituents. Nevertheless, the experimental evidence is not clear-cut.

The possible role of this enzyme in the metabolism of the moss plant has been discussed.

99 pages. $2.00. Mic 57-1177

FACTORS AFFECTING MYOGLOBIN CONCENTRATION

(Publication No. 20,492)

Willard Reilly Faulkner, Ph.D.
Vanderbilt University, 1956

Supervisors: Professors Frank R. Blood and William J. Darby

The work of many investigators has demonstrated that the in vitro characteristics of myoglobin are those of a respiratory pigment; however, its physiological role has not yet been fully established. The evidence available indicates that myoglobin is a distinct heme pigment and that it acts as a short-time store to maintain an optimal oxygen gradient between the cell membrane and the mitochondria.

In view of the structural and functional similarity of hemoglobin and myoglobin, it was considered that factors which influence the concentration of one might also affect the other. Hemoglobin concentration can be altered in a variety of ways acting through a number of mechanisms. Several factors which affect the concentration of hemoglobin were studied to determine their effect on the myoglobin level. After each method listed had been applied to a group of animals for a suitable time interval, the animals were sacrificed and their skeletal muscle assayed for myoglobin.

The factors studied can be classified with respect to their known or postulated mechanisms of action.

I. Effect on biosynthesis of hemoglobin
    1. Folic acid deficiency
II. Action on bone marrow
    1. Benzene
    2. X-irradiation
    3. Cobalt
III. Destruction of erythrocytes
    1. X-irradiation
    2. Acetylphenylhydrazine
IV. Direct addition to the hemoglobin pool
    1. Erythrocyte transfusion

Folic acid deficiency in animals represents a mechanism by which hemoglobin concentration is reduced through inhibition of its synthesis. The effect of this deficiency on myoglobin concentration in skeletal muscle was studied in guinea pigs and rats. The myoglobin level was elevated in guinea pigs but unaltered in rats. The increased level in the first of these two species was tentatively explained as an adaptive response induced by the lowered oxygen capacity of the blood. However, in view of accumulated evidence from subsequent experiments, such an explanation seems untenable. The period of anemia in the guinea pigs was short compared to that of the deficient rats. Furthermore, the experiments with x-irradiation, benzene exposure, cobalt administration and blood transfusion do not substantiate such view.

Species differences may have been responsible for the dissimilar findings in the folic acid deficient rats.

Benzene toxicity, x-irradiation and cobalt administration produced no change in the myoglobin concentration. Evidently these agents do not act directly on myoglobin or on the systems involved in its synthesis. Moreover, myoglobin is not altered indirectly by abnormal hemoglobin concentrations.

The administration of acetylphenylhydrazine resulted in markedly reduced myoglobin levels in the skeletal muscles of rats which had received this drug over a 3-month period. This finding was explained as an exhaustion of the supply of porphyrin precursors and of the functional capacity of the system involved in porphyrin synthesis. It was interpreted as indicating the existence of a common biosynthetic origin for porphyrins of hemoglobin and myoglobin.

Erythrocyte transfusion, which caused an increased level of hemoglobin, did not result in an alteration in myoglobin concentration. As this method of raising the hemoglobin level is uncomplicated by other factors, any changes observed in the myoglobin could be regarded as due purely to the elevated hemoglobin concentration. Since no change occurred, it can be concluded that a high hemoglobin concentration does not act directly to alter myoglobin.

It is apparent from the results of this investigation that myoglobin is stable with respect to its concentration and can be altered only by drastic means. Two methods were discovered that conclusively altered both hemoglobin and myoglobin concentration. They were acetylphenylhydrazine administration in the rat and folic acid deficiency in the guinea pig. 130 pages. $2.00. Mic 57-1178

ASPECTS OF CITRULLINE BIOSYNTHESIS

(Publication No. 20,238)

Leo McAloon Hall, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Philip P. Cohen

Previous investigations have demonstrated the existence of enzymes in mammalian liver which synthesize citrulline from carbon dioxide, ammonia, and ornithine in the presence of Mg^{++}, adenosine triphosphate and catalytic quantities of certain N-acyl derivatives of L-glutamic acid. The catalytic properties of the glutamyl derivatives had been ascribed to the formation of an unstable carbamyl intermediate (Compound X) containing the glutamate derivative, ammonia, carbon dioxide and phosphate in a mole-to-mole ratio. Following the demonstration of carbamyl phosphate synthesis by bacterial extracts, the question was raised whether Compound X is not actually carbamyl phosphate.

The studies reported here are consistent with the concept that Compound X is indeed carbamyl phosphate. This conclusion is based upon the following observations: (1) Employing chemical methods which are quantitative for acetyl L-glutamate, it is not possible to show a stoichiometric relationship between acetyl L-glutamate and Compound X. (2) Addition of isolated Compound X to a liver enzyme system capable of synthesizing citrulline in the presence of catalytic quantities of acetyl or carbamyl L-glutamate leads only to a stoichiometric conversion of the intermediate to citrulline. (3) Acetyl and carbamyl L-glutamate function catalytically in the formation of the intermediate carbamyl donor. (4) Comparative studies on the decomposition of Compound X and carbamyl phosphate reveal that the two are indistinguishable when identical analytical methods are used. The reported slow release of ammonia during the decomposition of Compound X is an artifact of the methods previously employed. (5) Carbamyl phosphate can be re-isolated from a simulated Compound X incubation mixture using the procedures described for the preparation of Compound X. The re-isolated cyclohexylammonium salt of carbamyl phosphate is chromogenic when analyzed for carbamylamino compounds, indicating that the apparent stoichiometry between Compound X and carbamyl L-glutamic acid observed by this analytical method is an artifact of isolation. (6) Anion exchange chromatography of a mixture of the intermediate carbamyl donor synthesized by liver enzymes and synthetic carbamyl phosphate results in an augmentation of the carbamyl phosphate elution peak.

Procedures for the isolation of acetyl L-glutamic acid from mammalian liver and yeast are described. It thus appears highly likely that acetyl L-glutamic acid is the natural catalyst or cofactor in carbamyl phosphate biosynthesis by mammalian liver enzymes, since it possesses the greatest catalytic activity and its presence in mammalian liver has now been demonstrated. The demonstration of acetyl L-glutamic acid in yeast raises the question of its metabolic significance in this organism.

Preliminary studies on the mechanism of action of acetyl and carbamyl L-glutamate in carbamyl phosphate synthesis reveal that both compounds are recovered from incubation mixtures unchanged. These data indicate that the glutamyl derivatives are not converted to a common catalytic agent, but function as such.

Attempts to demonstrate the in vitro synthesis of acetyl L-glutamic acid by a variety of liver preparations were not successful. 152 pages. $2.00. Mic 57-1179

STUDIES ON AN UNIDENTIFIED MINERAL REQUIRED BY THE CHICK

(Publication No. 20,420)

Alexander Baillie Morrison, Ph.D.
Cornell University, 1956

In studies on an unidentified mineral(s) required by the chick, evidence was obtained that the purified basal diets used contained adequate quantities of the known essential nutrients. Increased quantities of known essential vitamins, essential amino acids or linoleic acid had no influence on growth or efficiency of feed utilization to four weeks of age. In further studies, additional quantities of sodium and potassium, fed either alone or in combination, or additional magnesium did not improve growth. Increased amounts of the known essential major minerals, trace minerals, or complete mineral mixture did not significantly improve growth.

Although it was not possible to increase the nutritional adequacy of the basal diets by alteration of their content of known essential nutrients, a mixture of unidentified growth factor supplements, consisting of 6 parts of a composite sample of corn distillers' dried solubles, 3 parts of fish solubles, 3 parts of dried whey product, 3 parts of penicillin mycelium meal and 3 parts of forage juice concentrate markedly stimulated chick growth to four weeks of age. The ash of the mixture of unidentified growth factor supplements, and the ash of corn distillers' dried solubles alone, also markedly stimulated chick growth. The ash was prepared at 525^0 C. for four hours.

Considerable variability in response to the unidentified mineral nutrient(s) was observed over a two-year period. The reason(s) for the variability is unknown. Additional quantities of ash did not further stimulate growth response obtained from the ash of corn distillers' dried solubles, and that obtained from the intact material.

The increase in growth observed in chicks receiving the unidentified mineral nutrient(s) was proved not to be due to increased water retention, by carcass analysis studies.

Chicks fed the basal diet often developed an enlarged hock syndrome, characterized by enlargement and elongation of the intertarsal joint. The syndrome was only observed in chicks depleted of unidentified growth factor reserves at hatching. The mixture of unidentified growth factor supplements, or its ash, was markedly effective in reducing the incidence of the disorder. Intact or ashed corn distillers' dried solubles was somewhat less effective in reducing the incidence of the syndrome. Chicks fed the basal diet exhibited significantly lower percentage ash in the tibiotarsus than chicks fed the basal diet plus the unidentified mineral nutrient(s) and also exhibited a lower breaking strength of the tibiotarsus.

The unidentified mineral nutrient(s) had no influence on percentage hemoglobin, percentage red cell volume, or number of red cells.

A high dietary level of chlortetracycline did not

influence the percentage response obtained from the unidentified mineral(s).

Studies on the distribution of the unidentified mineral nutrient(s) showed that corn distillers' dried solubles and fish solubles contained the factor(s). A slight growth response was obtained from the minerals in gelatin.

The addition to the basal diet of compounds containing aluminum, arsenic, barium, beryllium, bismuth, boron, cadmium, cerium, cesium, chromium, fluorine, indium, iridium, lead, lithium, mercury, nickel, platinum, ruthenium, selenium, strontium, tantalum, thallium, thorium, tin, titanium, tungsten, vanodium, yttrium or zirconium had no influence on growth. Rubidium chloride obtained from one commercial source stimulated growth, but that obtained from a second source had no influence on growth. A consistent but not statistically significant growth response was obtained in two experiments from a mixture of rare earth oxides. A complex mineral solution stimulated growth, but a mineral mixture formulated on the basis of the spectrographic analysis of the ash of corn distillers' dried solubles had no effect. A slight response was obtained in two studies from the addition of a bromide salt to the diet.

The active factor(s) in the ash was found in the boiling water-insoluble portion of the ash, and appeared to be a cation. 104 pages. $2.00. Mic 57-1180

FUNDAMENTAL RATE PROCESSES CONCERNED WITH THE PHOTOCHEMICAL ACTIVITY OF ISOLATED CHLOROPLAST FRAGMENTS

(Publication No. 17,579)

John Samuel Rieske, Ph.D.
University of Utah, 1956

Chairman: Sherman Dickman

The photochemical activity of isolated chloroplast fragments, as determined by the potentiometric measurement of the rate of ferricyanide reduction, was for the first time critically measured as a function of the light intensity. The results indicated that the rate-light intensity relationship of this reaction (Hill reaction) can be accurately represented by a rectangular hyperbola. From this relationship it was possible to experimentally distinguish and measure two fundamental rate processes; a temperature dependent, "dark" process which was rate limiting at high light intensities, and a temperature independent, "light" process which was rate limiting at low light intensities. A study was made of the effects of temperature, light color, and pH as well as heavy water, salt, and ionizing radiation upon these processes.

The apparent activation energy of the "dark" process was found to vary between 9 kcal. and 12 kcal., in general confirming the results obtained previously in this laboratory in an independent study.

The "dark" process was found to be independent of the light color whereas the "light" process was strongly dependent upon wavelength, exhibiting maxima in the red and the blue regions and a minimum in the green region of the spectrum.

Both the "light" and the "dark" processes were highly pH dependent, both exhibiting bell shaped pH curves. The pH optimum of the "light" process was at about pH 6.3 whereas the "dark" process optimum was at about 7.3. Although the general relationship between the pH optima was preserved, the shape of the pH curves varied somewhat with different preparations. Also noted was a possible pH effect on the apparent activation energy of the "dark" process and a possible light inhibition at high pH's.

Measurement of the two processes in heavy water indicated that heavy water caused a rapid irreversible inactivation of the system rather than an inhibition as was previously assumed.

Sodium chloride was found to equally inhibit both the "light" and the "dark" processes. Analysis of the inhibition data indicated that both ions contributed to the inhibition.

Ionizing radiation was found to inactivate both the "light" and the "dark" processes, although in different ways. The "dark" process was inactivated in a zero order fashion whereas the "light" process was inactivated only after a several hour induction period.

The rectangular hyperbolic nature of the Hill reaction light curve as well as the other data can be interpreted in terms of a reaction mechanism involving as the fundamental kinetic unit an energy collecting and transferring system connected to an energy trapping, "dark" enzyme. 137 pages. $2.00. Mic 57-1181

STUDIES ON THE METHYLATION OF DEOXYURIDINE AND A FLUORIMETRIC DETERMINATION OF THYMINE

(Publication No. 20,760)

Buford DeWayne Roberts, Ph.D.
Washington University, 1957

Chairman: Dr. Morris E. Friedkin

This study considers the biological reactions involved in the methylation of 2-C^{14}-uracil deoxyriboside, deoxyuridine. Deoxyuridine has been shown to be incorporated into the thymine moiety of deoxyribonucleic acid, DNA. (Friedkin, J. Biol. Chem., 220:653, 1956) With chicken bone marrow the label from 2-C^{14}-uracil deoxyriboside is incorporated into an acid and alcohol soluble compound that was identified as thymidine by its paper chromatographic properties, by its absorption spectra in acid and alkali, and by its incorporation into chicken bone marrow DNA in the presence of Aminopterin.

The involvement of a folic acid derivative in the utilization of deoxyuridine by chick embryos was shown by inhibiting the formation of thymidine and the incorporation into DNA with Aminopterin, a folic acid antagonist. Similarly, Daraprim, a folic acid antagonist, and Aminopterin inhibited the incorporation into chicken bone marrow DNA. Citrovorum factor, a folic acid derivative, reversed the inhibition by Aminopterin and Daraprim. Neither folic acid antagonist inhibited the incorporation of thymidine into DNA which indicated that the block occurred prior to the formation of thymidine. Nitrogen mustard, methyl-bis- (β-chloroethyl) amine, inhibited the utilization of both deoxyuridine and thymidine.

Deoxycytidine and non-labeled deoxyuridine reduce the incorporation of 2-C^{14}-thymidine into DNA, and Aminopterin blocks the dilution of thymidine label. Deoxycytidine is more effective in reducing the incorporation of deoxyuridine into chicken bone marrow DNA than the incorporation of thymidine.

A fluorimetric assay for thymine, thymidine, thymidylic acid, and DNA has been developed. Thymine and its derivatives are converted to acetol which is coupled with o-aminobenzaldehyde to form highly fluorescent 3-hydroxyquinaldine. 5-Methyl cytosine is the only other derivative of nucleic acid that was found to form a fluorescent product in the assay. The assay has been applied to purified samples of DNA and to the measurement of the DNA content of various rabbit organs.

78 pages. $2.00. Mic 57-1182

CHEMISTRY, INORGANIC

STUDIES IN THE CHEMISTRY OF THE SILICON-HYDROGEN BOND (PARTS ONE-FOUR)

(Publication No. 19,462)

Mack Creede Harvey, Ph.D.
Indiana University, 1956

In this investigation repeated attempts were made under different conditions of temperature, concentration, and relative amounts of reactants to produce phenylchlorosilane and phenyldichlorosilane by the controlled reduction of phenyltrichlorosilane, using lithium aluminum hydride. This method was found unfeasible in that the main product of this reaction was phenylsilane.

Phenylbromosilane was prepared by the bromination of phenylsilane. Alkylphenylsilanes, $C_6H_5SiH_2R$, were synthesized by the treatment of phenylbromosilane with alkyl Grignard reagents. Among the alkylphenylsilanes obtained were eight new compounds: methylphenylsilane, ethylphenylsilane, n-propylphenylsilane, i-propylphenylsilane, n-butylphenylsilane, n-amylphenylsilane, n-hexylphenylsilane, and cyclohexylphenylsilane. The infrared spectra and near-infrared spectra of these silanes were recorded and discussed.

A high resolution infrared study of the silicon-hydrogen stretching vibration indicated that the vibrational frequency of the silicon-hydrogen bond is a linear function of the sum of the electronegativities of the groups attached to the silicon atom. It was noted that the methyl-silicon group exhibits almost the same electronegativity as that of the phenyl-silicon group. This is due to d_π-p_π-bonding between the silicon atom and the aromatic carbon atom.

The approximate frequency of the silicon-phenyl stretching vibration in tetraphenylsilane was calculated to be 523 cm^{-1}. The observed value is 512 cm^{-1}. The observed frequencies of the metal-phenyl stretching vibrations in tetraphenylgermane, tetraphenyltin, and tetraphenyllead are 478 cm^{-1}, 456 cm^{-1}, and 451 cm^{-1}, respectively. The silicon-phenyl vibration was observed in the spectra of thirteen substituted phenylsilanes.

Certain sterically hindered Grignard reagents were found to react with phenyltrichlorosilane, $C_6H_5SiCl_3$, to form dialkylphenylsilanes, $R_2C_6H_5SiH$, and unsaturated hydrocarbons. By such reactions dicyclohexylphenylsilane and cyclohexene, dicyclopentylsilane and cyclopentene, di-iso-propylphenylsilane and propene, and di-t-butylphenylsilane and isobutene were obtained. Attempts to prepare di-o-tolyphenylsilane by this method were unsuccessful. A mechanism involving transitory magnesium hydride was proposed to explain the mode of formation of the silicon-hydrogen bond.

1,3-diphenyldisiloxane was prepared and its reactions with lithium aluminum hydride, phenyllithium, methyllithium, methylmagnesium iodide, ethylmagnesium bromide, phenylmagnesium bromide, and benxylmagnesium chloride were studied. It was found that 1,3-diphenyldisiloxane was cleaved by Grignard reagents. It appears that Grignard reagents react with the disiloxane in two ways simultaneously: 1) addition to the silicon-oxygen bond to form an alkylphenylsilane and salt, $C_6H_5SiH_2OMgX$, and 2) alkylation of one silicon-hydrogen bond to form a salt, $C_6H_5SiHROMgX$, and phenylsilane, $C_6H_5SiH_3$. A mechanism, involving a halomagnesium hydride, was proposed for this reaction. 101 pages. $2.00. Mic 57-1183

THE PURIFICATION AND SOME CHEMICAL PROPERTIES OF THE METHYLVINYLBORANES

(Publication No. 20,397)

Morris Bernard Silverman, Ph.D.
University of Washington, 1956

Dimethylvinyl, methyldivinyl, and trivinylborane were prepared by the reaction between dimethylbromoborane and vinylsodium. They were purified by gas-liquid partition fractometry and identified by their molecular weights. Vapor pressures were measured.

Some chemical properties of the methylvinylboranes were studied. The effect of the vinyl group on the acidity of these compounds was observed by determining the relative stability of their ammonia complexes. Resistance of trivinylborane to air oxidation and shift of the infra-red absorption spectrum of the double bond are related to the change in bond order of the B-C bond.

By means of vapor pressure observations and fractometer patterns, several types of decomposition of the methylvinylboranes were observed.

58 pages. $2.00. Mic 57-1184

CHEMISTRY, ORGANIC

INFRARED SPECTRAL STUDIES OF LONG-CHAIN ALIPHATIC COMPOUNDS

(Publication No. 20,614)

Sanford Maxwell Aronovic, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Villiers W. Meloche

The discovery of uniformly-spaced series of bands, called band progressions, in the infrared spectra of some crystalline long-chain compounds prompted further study of this unusual spectral feature. These bands have been assigned to methylene wagging modes of vibration. An exploratory program was undertaken in this laboratory to detect and correlate progression bands in a great variety of long-chain compounds.

A Baird Associates Model B double-beam infrared spectrophotometer with NaCl optics was employed for this work. About two hundred compounds were examined from 5000 cm^{-1} to 660 cm^{-1} in the form of well-annealed crystalline films and as KBr pellets. The bands between 1400 and 1100 cm^{-1} were compared for structurally related groups of compounds to determine relationships between structure and band pattern.

It was found that the bands in all homologous series of $CH_3(CH_2)_nX$ compounds fell on similar simple families of curves when the progressions were plotted by frequency versus chain length. A low frequency limit of 1180 cm^{-1} was established for the band progression region. The high frequency limit was poorly defined, but no progression bands were recognized above 1380 cm^{-1}.

Theoretically, the number of bands for methylene wagging modes should be equal to the number of methylene groups in $CH_3(CH_2)_nX$ compounds of which X is not H or CH_3. In the short-chain compounds examined as solids, this was indeed the case, but only about half of the expected number of bands could be found in the long-chain compounds. Further studies revealed that, as chain length increases, pairs of bands approach each other and appear as single bands. It is thus evident that the uniformly-spaced bands which attracted attention in the spectra of the solid fatty acids seem to be unresolved pairs of methylene wagging frequencies. For chains about twenty carbons long, most of the progression bands are indicated to be merged pairs, and a few at the high frequency end are due to single vibrational modes. In longer chains, one band is added to the progression for each two additional methylenes.

A useful empirical rule is proposed for the determination of the chain length of n-aliphatic acids from the number of bands found between 1342 cm^{-1} and 1180 cm^{-1}, for precisely one band is in this region for every two carbons in the chain, from C_{10} to C_{36}. It appears likely that such a relationship may be established for many other n-aliphatic compounds as well, but the empirical definition of the high frequency limit must be made separately for each homologous series after examining many members of the series.

Previous findings that the end-group has only a small influence on the progression band frequencies, but a great effect on their intensities, were confirmed. Heavy substituents near the center of the chain have already been shown to disrupt the band pattern completely, but the present work has found this to be true even for isotopic substitution. Substitution near an end of the chain has little effect on the position of the low frequency bands, but affects the high frequency bands appreciably.

A band progression appears to be the most valuable feature of the infrared spectrum of a long-chain compound. The number of bands indicates the chain length, the regularity of spacing relates to chain substitution, and the intensity of the band progressions gives some information about the nature of the end groups.

139 pages. $2.00. Mic 57-1185

THE REACTION OF N-BROMOSUCCINIMIDE WITH CYCLOHEPTATRIENE AND REACTIONS OF THE BICYCLO(3.2.0)-2-HEPTEN-6-YL SYSTEM

(Publication No. 18,980)

Bill E. Burgert, Ph.D.
Northwestern University, 1956

The object of the first portion of this work was to provide support for the resonance stabilization of the cycloheptatrienyl carbonium ion. In order to do this an attempt was made to prepare cycloheptatrienylidene cyclopentadiene. The reaction of N-bromosuccinimide with cycloheptatriene did not give the expected product, cyclohepta-2,4,6-trienyl bromide, but instead gave a dibromide of cycloheptatriene and N-(cyclohepta-2,4,6-trienyl)succinimide. The structure of the latter compound was established on the basis of spectral and chemical data.

The hydrolysis of several 1-substituted cyclohepta-2,4,6-trienyl derivatives was studied. It was found that the hydrolysis of N-(cyclohepta-2,4,6-trienyl)-succinimide and cyclohepta-2,4,6-trienyl bromide gave benzaldehyde. These transformations were interpreted in terms of other known aromatizing rearrangements.

A modification of the Willstatter synthesis of cycloheptatriene was developed which involved a two step synthesis for the conversion of cycloheptene to cycloheptatriene. This method proved to be equally as good or better than the classical synthesis. Some light was shed upon the structure of cycloheptatriene by a comparative study of the reaction of maleic anhydride with cycloheptatriene and with ethyl norcaradiene carboxylate. Cycloheptatriene exhibited a low reactivity towards the dienophile at 5^0 while the bicyclic ester formed an 80% yield of adduct with maleic anhydride at 5^0. These results seem to indicate that cycloheptatriene is best represented in terms of the monocyclic structure, rather than as the bicyclic tautomer, norcaradiene.

The second portion of this work was concerned with the reactions of the bicyclo(3.2.0)-2-hepten-6-yl and bicyclo-(3.2.0)heptan-6-yl systems. The reduction of bicyclo-(3.2.0)-2-hepten-6-one with lithium aluminum hydride gave a three to one predominance of the endo bicyclo-(3.2.0)-2-hepten-6-ol while the reduction with aluminum isopropoxide gave a three to one predominance of exo bicyclo(3.2.0)-2-hepten-6-ol. Comparative studies of the solvolyses of the two methanesulfonate esters of these two alcohol mixtures showed that the predominantly endo alcohol mixture gave cycloheptatriene in 55% yield while the

predominantly exo alcohol mixture gave cycloheptatriene in only 7% yield. The solvolysis of the methanesulfonate ester of bicyclo(3.2.0)heptan-6-ol gave ^{3}-cycloheptenyl acetate but no hydrocarbon.

Several types of pyrolytic reactions were carried out in the bicyclo(3.2.0)-2-hepten-6-ol and bicyclo(3.2.0)heptan-6-ol series in an attempt to prepare bicyclo(3.2.0)hepta-2,6-diene, a valency tautomer of cycloheptatriene. The pyrolysis of bicyclo(3.2.0)-2-hepten-6-ol acetate at 550° gave toluene. Since cycloheptatriene was a possible intermediate in this reaction, its pyrolysis was studied. Using the same conditions cycloheptatriene afforded a 66% yield of toluene. The pyrolysis of the methyl sulfite of bicyclo-(3.2.0)-2-hepten-6-ol and the boric acid dehydration of bicyclo(3.2.0)-2-hepten-6-ol gave cycloheptatriene. The pyrolysis of bicyclo(3.2.0)heptan-6-ol acetate at 550° gave cycloheptadiene. The pyrolysis of the methyl sulfite of bicyclo(3.2.0)heptan-6-ol and the boric acid dehydration of bicyclo(3.2.0)heptan-6-ol gave a mixture of diolefinic hydrocarbons, the composition of which was not definitely established. Spectral data seem to indicate the presence of a considerable amount of cyclopropane containing material.

An attempt was made to open the four membered ring of bicyclo(3.2.0)-2-hepten-6-one to the monocyclic dihydrotropone. However the acid catalyzed reaction of bicyclo(3.2.0)-2-hepten-6-one with pyrrolidine apparently did not proceed with cleavage of the four membered ring.

139 pages. $2.00. Mic 57-1186

A STUDY OF THE HEMICELLULOSES OF WESTERN HEMLOCK (TSUGA HETEROPHYLLA)

(Publication No. 20,550)

Guy Gordon Studdy Dutton, Ph.D.
University of Minnesota, 1955

A sample of Western Hemlock (Tsuga heterophylla), free from bark, was finely ground and delignified by treatment with sodium chlorite and acetic acid. The holocellulose was extracted with five per cent potassium hydroxide and the hemicellulose isolated from the alkaline solution as its copper complex. Decomposition of the complex with methanolic hydrochloric acid yielded the hemicellulose as a cream-coloured powder amounting to about six per cent of the weight of air-dry sawdust. The polysaccharide had an equivalent weight of 1100, methoxyl three per cent, and $[\alpha]_D^{23}$ ca. -35° (c, 2 in 1% KOH). Acid hydrolysis of the polysaccharide gave an aldobiouronic acid, 2-O-(4-O-methyl-α-D-glucuronosyl)-D-xylose, together with xylose (37%), arabinose (8%), mannose (42%) and glucose and galactose (14%, calculated as glucose).

Methanolysis of the aldobiouronic acid afforded 4-O-methyl-D-glucuronic acid, characterized as its crystalline amide, and D-xylose which was obtained in crystalline form. Partial methylation of the aldobiouronic ester, reduction with lithium aluminum hydride and further methylation yielded a fully methylated disaccharide having a strong dextrorotation. Hydrolysis of this disaccharide gave 2,3,4,6-tetra-O-methyl-D-glucose, characterized as the crystalline sugar and as the anilide, and 3,4-di-O-methyl-D-xylose, identified as the crystalline 3,4-di-O-methyl-D-xylono-δ-lactone. This data showed the aldobiouronic acid to be 2-O-(4-O-methyl-α-D-glucuronosyl)-D-xylose.

The polysaccharide was methylated first with methyl sulphate and then with silver oxide and methyl iodide. Fractionation of the methylated material gave two polysaccharides: polysaccharide A, $[\alpha]_D^{25}$ -51°, and polysaccharide B, $[\alpha]_D^{25}$ -13°. This thesis is concerned with the study of polysaccharide A, but a few observations on polysaccharide B are included in the appendix.

By refluxing polysaccharide A with two per cent methanolic hydrogen chloride there were obtained an aldobiouronic acid and a mixture of neutral sugar glycosides. The aldobiouronic ester was reduced with lithium aluminum hydride and the resulting disaccharide hydrolyzed. There were obtained 2,3,4-tri-O-methyl-D-glucose, identified as the crystalline anilide, and 3-O-methyl-D-xylose, identified as the crystalline sugar and as the anilide.

The neutral sugar glycosides were hydrolyzed and the free sugars separated on a cellulose-hydrocellulose column using methyl ethyl ketone-water azeotrope. There were obtained 2,3,5-tri-O-methyl-L-arabinose; 2,3,4-tri-O-methyl-D-xylose; 2,3-di-O-methyl-D-xylose; 2-O-methyl-D-xylose; 3-O-methyl-D-xylose and traces of D-xylose.

The trimethylarabinose was characterized as 2,3,5-tri-O-methyl-L-arabonamide and the trimethylxylose as 2,3,4-tri-O-methyl-D-xylono-δ-lactone since trimethylxylose anilide failed to crystallize. The dimethylxylose was identified as the anilide and the two monomethylxyloses as crystalline sugars. The small amount of D-xylose was identified chromatographically and by optical rotation.

From this data a possible repeating unit for polysaccharide A has been proposed, consisting of a chain of 13 D-xylose residues linked through positions 1 and 4′ and having one L-arabinose unit joined to position 3 and three 4-O-methyl-D-glucuronic acid units joined to position 2 of the main chain. 80 pages. $2.00. Mic 57-1187

PART I. THE MECHANISM OF THE REDUCTION OF DIAZONIUM SALTS BY ALCOHOLS. PART II. THE REDUCTION OF DIAZONIUM SALTS BY PHOSPHOROUS ACID.

(Publication No. 19,415)

Alec Ervin Kelley, Ph.D.
Purdue University, 1956

Major Professor: Dr. Nathan Kornblum

Two paths are available for the reaction of diazonium salts with alcohols:

$$\text{Aryl-}N_2^+ X^- + RCH_2OH \longrightarrow \text{Aryl-}OCH_2R + N_2 + HX$$

$$\text{Aryl-}N_2^+ X^- + RCH_2OH \longrightarrow \text{Aryl-}H + RCHO + N_2 + HX$$

Earlier attempts to set forth a mechanism of the reaction have faltered on the lack of certainty as what process was being measured. Products were assumed, and sometimes incorrectly, to be the same as those reported by other workers for reaction conditions which differed from those under which the kinetic measurements were made.

This investigation is limited to the reaction of diazonium salts with alcohols in neutral or acidic solution, and in the absence of organic anions. Heretofore kinetic studies for such systems have dealt almost exclusively with the reactions of benzenediazonium chloride. In this work rate constants for the reaction in ethanol of benzenediazonium and p-toluenediazonium chlorides and p-toluenediazonium hydrogen sulfate were determined, and the products were identified directly from the solutions resulting from the kinetic measurements. The rate of reaction was followed by the evolution of nitrogen gas, and the products were determined by their ultraviolet spectra.

The free radical inhibitor, benzoquinone, at the five mole per cent level was found to have little or no effect on either the rates or products with the two diazonium chlorides. Although ferrous sulfate, and also pentabromobenzenediazonium hydrogen sulfate, did catalyze the reaction of benzenediazonium chloride, the amount of catalysis was small and shortlived. The addition of lithium chloride or lithium bromide to the diazonium salt in equimolar amount is seen from the table below to have only a small effect on the rate or products.

Salt (+ Added Substance)	Temp. °C	Rate Constant x 10^4 min^{-1}	Per Cent Yield of ArH	ArOR	ArX	N_2
Benzenediazonium$^+$ Cl^-	30	52.9	—	—	—	97
"	25	24.9	2.5	79	0.1	100
" + benzoquinone	25	24.9	—	—	—	97
" + 1 eq. LiCl	25	25.4	2.9	85	0.2	100
" + 1 eq. LiBr	25	26.0	3.4	75	0.4	97
p-Toluenediazonium$^+$ Cl^-	40	24.0	9.2	72	—	92
" + benzoquinone	40	23.9	7.0	—	—	92
p-Toluenediazonium$^+$ HSO_4^-	40	150 to 50	60	30	—	87
" + 1 eq. H_2SO_4	40	40.6	40	51	—	86
" + 10 eq. H_2SO_4	40	17.4	6.9	80	—	94

It should be noted that a smaller amount of benzene is formed than the 5-11% that has previously been reported in the literature. The most striking result of this series of reactions is the finding that with p-toluenediazonium hydrogen sulfate the reaction does not follow first order kinetics unless excess sulfuric acid is present, and that the proportion of reduction to toluene decreases with increase in acid concentration.

Although phosphorous acid can accomplish the replacement of a diazonium group by hydrogen, it is distinctly inferior to hypophosphorous acid for that purpose; the reaction is much slower, allowing competing processes to intervene.

When p-methoxybenzenediazonium chloride (which is relatively stable in aqueous solution) is used, the reaction in 5 M phosphorous acid is only 35% complete in thirty days at 25°. It is found that this reaction can be catalyzed by ether peroxide to give a yield of anisole that is almost as high as the yield from reaction with hypophosphorous acid. This catalysis suggests that a free radical chain process is possible utilizing the single P-H bond present in phosphorous acid, as has been demonstrated to occur with hypophosphorous acid.

109 pages. $2.00. Mic 57-1188

THERMAL REACTIONS OF gem-DIMETHYL TYPE CONJUGATED CYCLOHEXADIENES

(Publication No. 19,004)

Robert H. Kozlowski, Ph.D.
Northwestern University, 1956

A biallyl biradical mechanism was previously suggested to explain the thermal skeletal isomerization of the pyronenes, which terpenes are pyrolysis products of pinene. In order to test the validity of such a mechanism, a study of the thermal reactions of gem-dimethyl type conjugated cyclohexadienes has been undertaken.

The following gem-dimethyl type cyclohexadienes were synthesized for the study: 1,5,5-and 3,5,5-trimethyl-1,3-cyclohexadiene, 5,5-dimethyl-3-methylenecyclohexene and 5,5-dimethyl-1,3-cyclohexadiene.

The mixture of 1,1,3-trimethyl-endo-cyclohexadienes along with 5,5-dimethyl-3-methylenecyclohexene was obtained from the dehydration of isophorol. These three dienes had not been isolated previously. 5,5-Dimethyl-1,3-cyclohexadiene was prepared from 4,4-dimethylcyclohexene by bromination followed by the elimination reaction of Hofmann and Damm.

The thermal reactions were carried out at atmospheric pressure in a flow type system using quartz chips as the contact medium.

The reversible isomerization of the double bonds of the 1,1,3-trimethyl-endo-cyclohexadiene system took place between 300-400°. At 400-450° a skeletal rearrangement occurred which was accompanied by aromatization of the corresponding dienes.

A mixture of 1,1,3-trimethyl-endo-cyclohexadienes at 500° yielded gaseous and liquid products. The gas, amounting to 43 mole percent consisted of 73% methane, 18% hydrogen, 6% ethylene and 3% ethane. The liquid product was composed of 28 wt % m-xylene, 16% mesitylene, 22% 1,1,3-trimethyl-endo-cyclohexadiene, 4% 1,5-dimethyl-3-methylenecyclohexene and 30% 1,3,5-trimethyl-1,3-cyclohexadiene. The latter diene was independently synthesized by the dehydration of 1,3,5-trimethyl-2-cyclohexenol during the course of the Grignard reaction of methyl magnesium bromide with 3,5-dimethyl-2-cyclohexenone. This diene was isolated for the first time.

5,5-Dimethyl-3-methylenecyclohexene was found to be stable at 400° whereas at 500° it gave only 5-10% reaction, the products of which were endo-cyclohexadiene isomers and their thermal reaction products as given above.

5,5-Dimethylcyclohexadiene at 500° afforded gaseous and liquid products. The gas, amounting to 19 mole percent consisted of 61% methane, 35% hydrogen, 3% ethane and 1% propane. The liquid product was composed of 17 wt % m-xylene, 8% toluene, 15% 5,5-dimethyl-1,3-cyclohexadiene, 47% conjugated 1,3-dimethyl-endo-cyclohexadienes and 12% semicyclic diene isomers of the latter.

The analytical procedure included fractional distillation, infrared, ultraviolet and mass spectral methods, selective hydrogenation, chromatography and catalytic aromatization. The structures and/or presence of the individual endocyclic dienes were further determined through the reaction with dimethyl acetylenedicarboxylate.

A biallyl biradical mechanism was proposed to explain the various products of the reactions.

209 pages. $2.75. Mic 57-1189

REARRANGEMENTS AND RING CLOSURES OF SOME PERI-SUBSTITUTED NAPHTHALENES

(Publication No. 19,571)

Peter Thomas Lansbury, Ph.D.
Northwestern University, 1956

Supervisor: Robert L. Letsinger

The synthesis and reactions of some peri-substituted naphthalenes were undertaken with hope of obtaining some rearrangements involving the peri groups. The choice of this system of compounds for study was based on the favorable geometry of this system, since the peri-substituents are extremely close to one another and coplanar with the naphthalene nucleus. Three new types of molecular rearrangements were observed: (1) an isomerization involving a 1,5-phenyl shift; (2) an intramolecular dismutation involving a 1,5-hydride shift; and (3) a rearrangement of a methylene ether to a ketone.

When 8-benzhydryl-1-naphthoic acid was converted to the acid chloride and then treated with stannic chloride, a rearrangement occurred; the cyclic hemiketal of 1-benzoyl-8-phenylhydroxymethylnaphthalene was obtained in 90% yield. This conversion was also accomplished when the carboxylic acid was heated in 90% sulfuric acid, although the yield of isomeric hemiketal was lower. The structure of this product was confirmed by elemental analysis, infrared spectrum and conversion to the ethyl ketal by means of absolute ethanol and sulfuric acid. Furthermore, the hemiketal was oxidized with chromic acid to 1,8-dibenzoylnaphthalene and reduced with lithium aluminum hydride to 1,8-bis-(phenylhydroxymethyl)naphthalene.

This rearrangement is unique in that it constitutes the first example of a nucleophilic rearrangement in which an alkyl or aryl group migrates between unbonded carbon atoms. The key step is, in fact, a 1,5-shift of a phenyl group in the intermediate carbonium ion. Moreover the formation of an acyl carbonium ion as the initial electron deficient center is equally without precedent insofar as rearrangement reactions are concerned.

The rearrangement of 8-di-p-anisylmethyl-1-naphthoic acid to the cyclic hemiketal of 1-p-anisoyl-8-p-anisylhydroxymethylnaphthalene provided evidence that the above rearrangement involves a direct aryl migration.

A reaction involving a 1,5-hydride transfer was the rearrangement of the cyclic hemiacetal of 8-diphenylhydroxymethyl-1-naphthaldehyde in acid solution to 8-benzhydryl-1-naphthoic acid. The hemiacetal was obtained by lithium aluminum hydride reduction of diphenyl-1,8-naphthalide and it could be rearranged in 100% yield when iodine and acetic acid were used. The disproportionation and generation of a carbonyl group resemble the pinacol rearrangement mechanistically.

The reaction of diphenyl-1,8-naphthalide with methylmagnesium iodide resulted in the replacement of the carbonyl oxygen atom by a methylene group. The resultant methylene ether was rearranged in acid to 3,3-diphenyl-2,3-dihydrophenalone, an isomeric ketone. This rearrangement probably involves a ring opening of the peri-ring followed by an acid-catalyzed enolization of the resultant acetyl group. The ring may then close by alkylation of the enol double bond, with the result that the methylene group has replaced the ethereal oxygen, and the latter appears as the carbonyl oxygen in the rearranged ketone.

Evidence was presented concerning the reactivity of cyclic hemiketals and hemiacetals toward basic reagents, where peri-ring opening is involved. It has been shown that 8-diphenylhydroxymethyl-1-naphthaldehyde hemiacetal does not react with lithium aluminum hydride or phenyllithium, whereas 1-benzoyl-8-phenylhydroxymethylnaphthalene hemiketal undergoes ring opening and carbonyl addition with both these reagents. The inactivity of the above hemiacetal was attributed to rotational hindrance to ring opening and steric hindrance to carbonyl addition caused by the gem-diphenyl group.

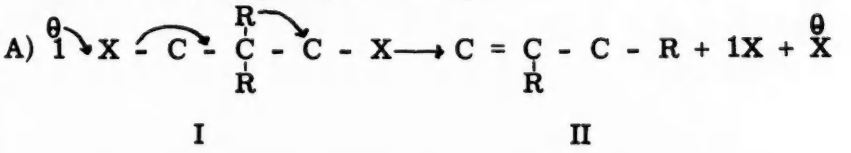
107 pages. $2.00. Mic 57-1190

A STUDY OF SOME BASE INDUCED REARRANGEMENTS

(Publication No. 20,386)

Sidney Morcus Leahy, Jr., Ph.D.
University of Washington, 1956

Six 1,3-dihalides were found to react with iodide ion in acetamide or dimethylformamide solution at 120-160° to give, in moderate yields, the olefin II or an olefin easily derived from II by isomerization. The general reaction is shown in Equation A. In this equation X is bromine or iodine and R is hydrogen or alkyl.



Thus, 1,3-dibromopropane gave propylene, 1,2-dibromo-2-methylpropane gave isobutylene, 1,3-dibromo-2,2-dimethylpropane gave a mixture of 2-methyl-2-butene and 1,1-dimethylcyclopropane, 1,1-bis-(bromomethyl)-cyclopropane gave a mixture of methylenecyclobutane and 1-methylcyclobutene, 1,1-bis-(iodomethyl)-cyclobutane gave methylenecyclopentane and 1,1-bis-(bromomethyl)-cyclopentane gave 1-methylcyclohexene. Under the conditions described above, 1,1-bis-(bromomethyl)-cyclohexane and 1,3-dibromo-2-phenylpropane failed to give olefinic products and decomposed to tarry materials. It is seen that the reaction may proceed by a 1,2-shift of either a hydrogen or an alkyl group. In the one phenyl compound tested, no phenyl group migration was observed.

In the elimination-rearrangement reactions of 1,1-bis-(bromomethyl)-cyclopropane, and 1,1-bis-(bromomethyl)-cyclopentane the olefin predicted by Equation A can isomerize to the product actually observed. This was shown by the fact that under the conditions of the reaction methylenecyclohexane isomerized almost completely to 1-methylcyclohexene. Methylenecyclobutane isomerized partially to 1-methylcyclobutene, giving a mixture of the same composition as that obtained from the elimination reaction.

Cyclopropane compounds are not, in general, intermediates in the formation of the observed olefin product since 1,1-dimethylcyclopropane and methylcyclopropane do not isomerize to olefinic products under the conditions of the reaction.

With one exception, all of the starting 1,3-dihalides

remained unchanged in the presence of iodine in solution at the temperature at which the rearrangement reaction occurs. This indicates that the reaction does not proceed through the sequence of acid catalyzed rearrangement of the starting 1,3-dihalide to a 1,2-dihalide followed by vicinal dehalogenation of this 1,2-dihalide by iodide ion. In the exceptional case mentioned, 1,1-bis-(bromomethyl)-cyclopropane, rearrangement in the presence of iodine does occur to give appreciable amounts of 1-bromomethyl-1-bromocyclobutane.

The evidence cited in connection with the reaction of 1,3-dihalides with iodide ion points strongly to the mechanism of the general equation, i.e., one involving a negatively charged transition state. The relative participation of basic and acidic species in this reaction is not known but since no rearrangement occurs in the absence of iodide ion it is apparent that iodide ion plays an important role.

The reaction of γ-bromo-β,β-dimethylbutyric acid and diethyl α-bromo-β,β-dimethylglutarate with hydroxide ion produced only gamma β,β-dimethylbutyrolactone and gamma β,β-dimethyl-γ-carboxybutyrolactone, respectively. In these cases rapid lactone formation apparently reduces appreciably the possibility of a rearrangement reaction analogous to that observed in the case of 1,3-dihalides. It was found, however, that α-bromo-t-butylacetic acid undergoes simultaneous elimination and rearrangement in basic solution to give 2-methyl-2-butene.

123 pages. $2.00. Mic 57-1191

AN EXAMINATION OF POSSIBLE SYNTHETIC ROUTES TO CYCLODECAPENTAENE

(Publication No. 20,385)

George Morrow Le Clercq, Ph.D.
University of Washington, 1956

In order to obtain more information about the structural features which are necessary for aromatic character in organic molecules, the synthesis of cyclodecapentaene was undertaken. It is believed that this compound will have a relatively planar configuration allowing a large degree of pi orbital overlap. The delocalization energy was calculated semi-empirically to be 57 kcal. per mole which indicates that cyclodecapentaene should exhibit aromatic character comparable to that of naphthalene and superior to that of azulene. The strain energy was not calculated, but models indicate that the molecule will not be excessively strained.

Three synthetic routes were examined, and one of these routes showed promise as far as it was carried out. The synthesis of a cyclodecapentaene derivative by means of the ring closure of a diester containing all of the necessary unsaturation by an acyloin condensation was not successful. Using dimethyl cis,cis-muconate as a model compound, it was found that isomerization of the double bonds to the more stable trans-configuration took place preventing the ends of the molecule from getting close enough for reaction.

The second route that was followed involved the formation of a 10-carbon ring system containing a nitrogen bridge which would give the ring more rigidity and hold the sides of the ring apart, precluding the possibility of transannular effects during further reactions on the system while introducing the necessary unsaturation. The acyloin condensation of dimethyl N-methyl-2,5-pyrrolidinedipropionate failed, undoubtedly due to the stereoconfiguration of the molecule. The diester was recovered unchanged or, in some cases, partially polymerized.

The use of an oxygen-bridged intermediate was attempted next. The acyloin condensation of dimethyl 2,5-tetrahydrofurandipropionate gave 11-oxabicyclo[6.2.1] undecane-4-one-5-ol in fair yield. Several reactions were carried out on this compound resulting in the preparation of the corresponding diol and dione. An attempt to prepare 11-oxabicyclo[6.2.1]-undecene-4 by sodium iodide elimination of the ditosylate in acetone gave only inconclusive evidence of its formation.

During the course of this work, it was found that the presence of conjugated dienes, even furan derivatives, inhibits the acyloin condensation completely. However, the presence of α,β-unsaturated esters does not appear to be troublesome since the addition of dimethyl fumarate to dimethyl sebacate did not inhibit the formation of sebacoin.

In conclusion it was found that although the acyloin condensation offers a convenient method for the attainment of large hydrocarbon ring systems, the formation of rings from compounds already containing dienoid or greater unsaturation does not appear to be possible. The 11-oxabicyclo[6.2.1]undecane system shows much promise as a means for preparing cyclodecapentaene because of the stability of the system and the presence of the oxygen bridge to prevent transannular effects.

161 pages. $2.15. Mic 57-1192

STUDIES IN THE STEREOCHEMISTRY OF SOME DISUBSTITUTED DIOXANES

(Publication No. 19,574)

Gregory James Lestina, Ph.D.
Northwestern University, 1956

Supervisor: Robert K. Summerbell

A disubstituted dioxane has been synthesized via the condensation of 1,4-butadiene with mercuric nitrate in the presence of ethylene glycol. The product after precipitation of the adduct as the halide followed by the replacement of the halomercuri group with iodine yielded a mixture of cis and trans-2,3-bis(iodomethyl)-p-dioxane which mixture was separated by fractional crystallization. Nitric acid oxidation of the trans diiodide produced the trans dicarboxylic acid in good yield and without isomerization. This acid was partially resolved into its optical isomers and also isomerized to a mixture of cis and trans diacids. The trans anhydride was converted to the cis anhydride by means of refluxing acetic anhydride. Hydrolysis of the cis anhydride produced the cis diacid which could not be resolved into optical isomers. Oxidation of the cis iodide with nitric acid produced the cis-3-hydroxymethyl-2-p-dioxanecarboxylic lactone in good yield. When cis-2,3-bis(p-toluenesulfonatomethyl)-p-dioxane which had been formed from the product obtained from the reduction of dimethyl cis-2,3-p-dioxanedicarboxylate was treated with sodium iodide, the cis diiodide was obtained thus relating the cis diacid to the cis diiodide.

A novel synthesis of a substituted dioxadiene was performed by means of the application of a known reaction to readily available starting material. When trans-2,5-bis-(iodomethyl)-p-dioxane was treated with hot sodium hydroxide in a water carbitol mixture there was produced in good yield a stable liquid diolefin which was assumed to be 2,5-bis(exomethylene)-p-dioxane. This liquid was isomerized by means of palladium on charcoal catalyst to another stable liquid diolefin which was shown to be 2,5-dimethyl-p-dioxadiene. Treatment of both of these diolefins with methanol in the presence of a trace of acid produced a substance identified as 2,5-dimethyl-2,5-dimethoxy-p-dioxane, thus supporting the structure assignment of the dimethoxy acetal of dimeric hydroxyacetone.

Allyl ether has been condensed with aqueous mercuric acetate under various conditions of time, acidity and temperature to give, after the appropriate sequence of reactions, mixtures of cis and trans-2,6-bis(iodomethyl)-p-dioxane. Although the cis isomer was not formed exclusively when mercuric acetate was used, it was found that the proportions and yields of that isomer could be markedly increased by higher reaction temperature, higher acid concentration, and by longer elapsed time before workup. The reaction was postulated as being reversible and proceeding by means of a carbonium ion intermediate. 90 pages. $2.00. Mic 57-1193

PART I: AN EXAMINATION OF THE ELIMINATION REACTIONS OF GLYCOL FORMATES. PART II: THE ATTEMPTED PREPARATION OF HEXAPENTAENE. PART III: INTERACTION OF THE BENZENE RING WITH SOLVENT IN THE SOLVOLYSIS OF BENZYL HALIDES.

(Publication No. 20,387)

Winston Dale Lloyd, Ph.D.
University of Washington, 1956

Part I:

An investigation of the pyrolytic elimination of the elements of formoyl peroxide from the diformates of 1,2 diols has shown that catalysis is not an important factor and that a cis elimination path is preferred. These facts are consistent with a concerted cyclic elimination mechanism. Steric requirements similar to those observed in this work have been interpreted as indicating a planar cyclic transition state. The reaction under consideration, as well as the earlier examples, are cited in this work as being more consistent with a nonplanar cyclic transition state. If a planar transition state were required, eliminations from the trans alicyclic derivatives would have to yield trans olefins while, in fact, cyclohexane and cyclopentane rings cannot accomodate a trans double bond. Successful elimination reactions were achieved in instances in which the compound was substituted with a formyloxy group on one carbon atom and other ester groups (instead of formyloxy) on the adjacent carbon atom, but not in instances in which the adjacent carbon atom was substituted with chlorine or methoxy or was a carbonyl group. Upon pyrolysis, 2-butene-1,4-diol diformate underwent a 1,4 elimination to yield butadiene. Although no examination of the steric requirements for 1,4 elimination has been undertaken, the compound under consideration would be expected to present no steric difficulties in the formation of a cyclic transition state.

Part II:

Only two unsubstituted cumulenes are known, allene and butatriene. Allene is a stable compound and has been extensively investigated while butatriene is very unstable and has been characterized only recently. The physical and chemical properties of hexapentaene are expected to be similar to those of butatriene, and it was thought that the method of preparation of butatriene which was developed in these laboratories by Lanka and Liddicoet might prove successful for the preparation of hexapentaene.

The dehalogenation of 2,4-hexadiyne-1,6-dibromide with zinc in diethylene glycol diethyl ether gave a small amount of a moderately volatile somewhat unstable liquid which was not fully characterized. The infrared spectrum of this material is reported and a bromine derivative has been prepared.

Part III:

An attempt has been made to determine the importance of solvation, at or near the para position, in the solvolysis of benzyl halides. The technique employed, the measurement of the rates of solvolysis of the optical isomers of 2-p-sec-butylphenyl-2-chloropropane in optically active 2-butanol, would be expected to detect preferential solvation of one enantiomorph if solvation of the benzene ring is important in stabilizing the positively charged transition state. Experimental errors were large enough to preclude any unequivocal interpretation of the results.

130 pages. $2.00. Mic 57-1194

A SIDE REACTION OF THE WILLIAMSON SYNTHESIS

(Publication No. 19,018)

William Brady Martin, Ph.D.
Northwestern University, 1956

It has been previously shown that the reaction of sodium phenethoxide with benzyl chloride in toluene, the Williamson reaction, produced not only the expected benzyl phenethyl ether but also a quantity of the carbon alkylation product, 2-benzyl-2,3-diphenylpropanol. It is the intent of this work to investigate in greater detail the formation of the carbon alkylation product and to describe a reasonable reaction course or sequence of reactions for its formation

$$Ph\text{-}CH_2CH_2OH + PH\text{-}CH_2Cl \longrightarrow Ph\text{-}CH_2CH_2OCH_2Ph$$

$$+ Ph\text{-}\underset{\displaystyle CH_2Ph}{\overset{\displaystyle CH_2Ph}{\overset{|}{\underset{|}{C}}}}\text{-}CH_2OH$$

To this end, it has been proposed that the reaction course leading to the formation of the carbon alkylation product can be described by the following sequence. Namely, the reversible oxidation-reduction system present when an alcohol, primary or secondary, and a carbonyl compound are together in the presence of alkoxide ion, allows the alcohol to be oxidized to the corresponding aldehyde and this in turn being alkylated by the organic halide

present. This carbon alkylation product can either be isolated as the aldehyde or alcohol depending on the position of the equilibria for the particular system under investigation.

$$Ph\text{-}CH_2CH_2OH + \text{carbonyl compound} \rightleftharpoons Ph\text{-}CH_2CHO + \text{alcohol}$$

$$PhCH_2CHO + PhCH_2Cl \longrightarrow Ph\text{-}\underset{\displaystyle CH_2Ph}{\overset{\displaystyle CH_2Ph}{\overset{|}{\underset{|}{C}}}}\text{-}CHO$$

$$\underset{\displaystyle CH_2Ph}{\overset{\displaystyle CH_2Ph}{\overset{|}{\underset{|}{Ph\text{-}C}}}}\text{-}CHO + \text{alcohol} \rightleftharpoons \underset{\displaystyle CH_2Ph}{\overset{\displaystyle CH_2Ph}{\overset{|}{\underset{|}{Ph\text{-}C}}}}\text{-}CH_2OH + \text{carbonyl compound}$$

Specifically the reaction of benzyl chloride with phenethyl alcohol, 3-phenylpropanol and 4-phenylbutanol with various oxidants, aldehydes such as phenylacetaldehyde and benzaldehyde or ketones such as benzophenone, cyclohexanone and fluorenone, has been investigated and the resulting carbon alkylation products, 2,2-dibenzyl-3-phenylpropanol from 3-phenylpropanol and 2,2-dibenzyl-4-phenylbutanol from 4-phenylbutanol, have been isolated and characterized. The structures for these carbon alkylation products have been proven by synthesis, and by suitably adjusting the Williamson reaction conditions this alkylation by-product can be made the major reaction product. The reaction scope was extended successfully by using allyl chloride as another alkylating agent and the effect of solvent or temperature was briefly examined.

This carbon alkylation side reaction seems to be a general one and is probably active to some degree in the normal course of the Williamson synthesis with primary and secondary alcohols. 69 pages. $2.00. Mic 57-1195

SYNTHESIS AND REACTIONS OF 1-HEPTAFLUOROPROPYLMAGNESIUM BROMIDE

(Publication No. 19,448)

Alfred Francois Meiners, Ph.D.
Purdue University, 1956

Major Professors: E. T. McBee and C. W. Roberts

Part I

Phenylmagnesium bromide reacts rapidly and quantitatively with heptafluoro-1-iodopropane to provide a new synthesis of 1-heptafluoropropylmagnesium bromide (I). Other Grignard reagents, especially aryl Grignard reagents, are also useful in the exchange reaction. The exchange preparation has considerable advantage over the direct preparation of (I) from heptafluoro-1-iodopropane and magnesium because the thermally unstable reagent can be prepared rapidly at Dry Ice temperature. Subsequent treatment of (I) with acetaldehyde, butyraldehyde, acetone, acetophenone, benzophenone and cyclohexanone gives the corresponding alcohols in yields of 30%, 46%, 85%, 77%, 62%, and 90%, respectively.

In a study of the thermal stability of (I), the reagent was shown to decompose rapidly at 2°, 92% in 6 hrs., but to be stable at Dry Ice temperature, being only 10% decomposed after 24 hrs.

Pentafluoroethylmagnesium bromide was prepared by the exchange reaction of pentafluoroethyl iodide with phenyl magnesium bromide. Subsequent treatment of this reagent with acetone gave the corresponding alcohol in 38% yield.

Part II

1-Heptafluoropropylmagnesium bromide reacts with 2-cyclohexenone to give an intermediate alcohol which was dehydrated to 2-(heptafluoropropyl)-1,3-cyclohexadiene (II) (42%). No 1,4-addition of the perfluoro Grignard reagent to 2-cyclohexenone was observed. Treatment of (II) with N-bromosuccinimide, followed by thermal dehydrobromination gave (1-heptafluoropropyl)benzene (53%), the first reported (perfluoroalkyl)benzene having a perfluoroalkyl sidechain longer than two carbon atoms. The ultraviolet spectrum of (1-heptafluoropropyl)benzene indicated characteristic mono-substituted benzene maxima and was very similar to the spectrum of benzotrifluoride.

137 pages. $2.00. Mic 57-1196

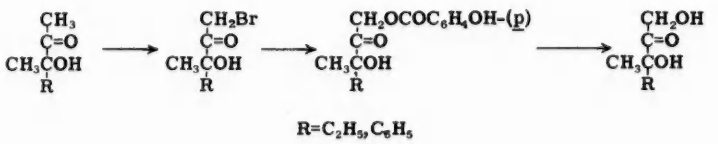
SYNTHETIC AND STRUCTURAL STUDIES RELATING TO ACYCLIC GLYCOLYLCARBINOLS DERIVED FROM BIACETYL

(Publication No. 20,484)

Richard Andrew Mikulec, Ph.D.
State College of Washington, 1956

One of the objectives in this investigation was to explore possible crystalline ester intermediates in the synthesis of glycolylcarbinols. 1,3-Dihydroxy-3-methyl-2-pentanone had been prepared previously by the use of a liquid acetate intermediate. However, attempts to use the same procedure for the preparation of 1,3-dihydroxy-3-phenyl-2-butanone had not proved successful.

A second objective of these studies was to provide chemical evidence in support of the dihydroxyacetone structure that had been assigned previously to 1,3-dihydroxy-3-methyl-2-pentanone.



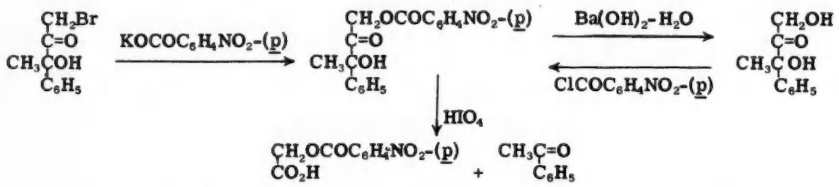
$R=C_2H_5, C_6H_5$

Because of prior experience in the series where $R=C_2H_5$, attempts were made to prepare a solid p-hydroxybenzoate. A nicely crystalline ester was obtained in 32% yield. The p-hydroxybenzoate in the $R=C_6H_5$ series, however, was not obtained in good yield, and considerable difficulty was encountered in attempted purification of the substance. Both of these p-hydroxybenzoates were converted, in good yields, to their benzoyl derivatives; these derivatives were subjected to periodic acid cleavage and yielded 2-butanone and acetophenone respectively (isolated as the 2,4-dinitrophenylhydrazones). The benzoyl derivative in the $R=C_2H_5$ series was obtained also from the

corresponding glycolylcarbinol by direct esterification with p-benzoyloxybenzoyl chloride.

When the p-hydroxybenzoate in the R=C_2H_5 series was subjected to methanolysis, there was obtained only a 10% yield of 1,3-dihydroxy-3-methyl-2-pentanone. Methanolysis of the p-hydroxybenzoate in the R=C_6H_5 series gave a 34% recovery of starting material and only a trace of acetophenone (isolated as its 2,4-dinitrophenylhydrazone).

Because of the above results obtained with the p-hydroxybenzoates, a p-nitrobenzoate was prepared in the R=C_6H_5 series (yield, 68%). When this p-nitrobenzoate was



subjected to the conditions of methanolysis employed previously to prepare 1,3-dihydroxy-3-methyl-2-pentanone, there was obtained a 71% yield of methyl p-nitrobenzoate and a reddish-brown oil which was not identified. It was found, however, that by using just slightly more than one equivalent of barium hydroxide at 0°, this p-nitrobenzoate could be saponified to give 1,3-dihydroxy-3-phenyl-2-butanone in good yield.

Treatment of 1,3-dihydroxy-3-phenyl-2-butanone with p-nitrobenzoyl chloride gave a substance which was identical to the original p-nitrobenzoate. To confirm the structure assigned to this compound, the p-nitrobenzoate was cleaved with periodic acid to acetophenone (isolated as its 2,4-dinitrophenylhydrazone in 91% yield) and O-p-nitrobenzoylglycolic acid (isolated in 89% yield).

31 pages. $2.00. Mic 57-1197

THE ASYMMETRIC REDUCTIONS OF CYCLOHEXYL ALKYL KETONES AND OF SUBSTITUTED BENZOPHENONES

(Publication No. 20,463)

Elizabeth Dunning Parker, Ph.D.
Stanford University, 1957

The reactions of four substituted benzophenones with the Grignard reagent from (+)-1-chloro-2-methylbutane have been investigated. p-Methoxybenzophenone and p-chlorobenzophenone were reduced by this reagent to the respective optically inactive benzhydrols, whereas o-chlorobenzophenone yielded partially active o-chlorobenzhydrol. These results were interpreted in terms of the proposed mechanism for the reduction of carbonyl compounds by Grignard reagents involving a cyclic, six-membered transition complex. The reaction of 2,6-dichlorobenzophenone with the same Grignard reagent afforded anomalous products.

The extents of asymmetric reduction of a series of six cyclohexyl alkyl ketones by the Grignard reagent from (+)-1-chloro-2-methylbutane have been determined. The optical rotations of the partially active cyclohexylalkylcarbinols from the Grignard reactions were compared with known rotations of the pure optical isomers. The configurations of the preponderant enantiomorphs formed in the Grignard reactions have been related to those of the corresponding phenylalkylcarbinols, of known relative configuration, by procedures involving catalytic hydrogenation of the latter. Cyclohexyl-i-propylcarbinol has been resolved. Cyclohexyl-i-butylcarbinol and cyclohexyl-t-butylcarbinol were not resolved; the rotations of the optically pure forms were calculated by quantitative treatment of the data from the catalytic hydrogenations.

The effects of structural changes in the alkyl group on the extent of asymmetric reduction in the cyclohexyl alkyl series were compared to similar effects in the phenyl alkyl series studied by MacLeod. Both series exhibited a similar increase in stereospecificity of reduction with increasing length of the alkyl chain provided the α-carbon was unbranched. Branching at the α-carbon in the cyclohexyl alkyl series greatly diminished the stereospecificity of reduction, in marked contrast to the effect of α-branching in the phenyl alkyl series.

Only semi-quantitative correlation of these results with earlier data has been possible on the basis of the proposed mechanism, and significant deviations occur. These have been attributed not to a defective mechanism but to the inadequacy of methods now available for the study of complex transition states. At present it is known only that the effect of one substituent of the carbonyl compound on the stereospecificity of reduction is highly dependent in no simple way on the identity of the second substituent.

108 pages. $2.00. Mic 57-1198

HIGH TEMPERATURE STUDIES OF AROMATIC AND NITROGEN HETEROCYCLIC MOLECULES

(Publication No. 19,599)

Justine Isabel Simon, Ph.D.
Northwestern University, 1956

Supervisor: Charles D. Hurd

The fundamental difference previously reported between the pyrolytic products of benzene and toluene has been verified. Condensed nuclear molecules are produced from toluene but not from benzene.

Pyridine, 2-, 3- and 4-picolines have been studied over the temperature range 700-850° C. in an attempt to discover how a side chain on an aromatic molecule affects its mode of decomposition. 2-Methylpyrazine has also been studied, but in less detail.

The apparatus consisted of a vaporizing unit, an electric furnace into which the vapor of a compound to be studied was forced, a thermocouple connected to a Leeds and Northrup "Micromax" temperature recorder-controller, and the condensation train.

Compounds were carefully purified before use in such a way that the absence of any of the products in the starting material was established. Infrared spectral methods of analysis for the products have been developed. These methods include analyses for 2-, 3- and 4-picoline and pyridine in any conceivable combination of these four compounds. Chemical methods of identification of some of the products have been adapted to micro amounts. Gas analyses were done in a modified Orsat apparatus.

The order of increasing stability of these compounds at

850° was as follows: 2-methylpyrazine, 4-picoline, 3-picoline, 2-picoline, pyridine. For the picolines the following generalizations were observed.

At 700° decomposition became measurable. Picolyl radicals, $C_6H_4N{+}CH_2{-}$, formed first, and pyridine was produced by a secondary reaction. Yields of pyridine increased with rise in temperature, reaching a maximum of 25% at 850° based on unrecovered picoline.

At 750° there was rearrangement of each picoline to its isomers. The evidence shows that this rearrangement was a stepwise intramolecular shift of the methyl group (or methylene radical) along the ring.

At 775° there was evidence of ring breakage. Benzene, acetonitrile, acrylonitrile, quinoline and benzonitrile were identified and quantitatively determined in the liquid products. The amount of ethylene in the gaseous products was found never to exceed 2.2%. Acetylene was absent. Hydrogen cyanide was produced in all the runs.

At 825° pyridine itself gave similar products of ring breakage to those mentioned above, though the amounts of these products varied among the four compounds.

2-Methylpyrazine gave rise to much greater quantities of the nitriles than the other compounds did, but to no benzene. This was interpreted as an exhibition of the driving force of nitrile group formation whenever possible.

Evidence has been obtained from the literature and from this work to show that the sequence, starting material ⟶ olefin ⟶ activated olefin or olefin dimer ⟶ aromatic molecule, is not as probable as the sequence, starting material ⟶ free radical fragment ⟶ aromatic molecule, in these pyrolyses.

The fact that these free radical fragments appear at a lower temperature in the picoline series than in pyridine has been explained by postulating that the initial formation of picolyl radicals results in a weakening of specific bonds in the nucleus. A reverse Diels-Alder decomposition has been shown to be an inadequate theory for explaining the products of ring cleavage.

It has been proposed that toluene gives rise to condensed nuclear aromatic molecules because the initial production of the benzyl radical likewise weakens specific bonds in the nucleus, enabling free radical fragments to be formed at temperatures where they exist long enough to form new molecules. It has been proposed that the side chain is not an essential part of these fragments. Benzene does not decompose to these fragments because there is no factor inherent in its structure, such as a side chain or a hetero-atom, to cause one bond to break before another.

123 pages. $2.00. Mic 57-1199

THE AXIAL EFFECT

(Publication No. 19,875)

Robert David Stolow, Ph.D.
University of Illinois, 1956

Part I. The Competitive Bimolecular Substitution and Elimination Reactions of N,N,N-Trimethylcyclohexylammonium Ions

The axial effect has been defined to be the rate depression resulting when a bulky equatorial substituent of the preferred chair conformation of a cyclohexane derivative is forced into the sterically less favorable axial position in the transition state of a reaction [D. Y. Curtin, Record Chem. Progr. Kresge-Hooker Sci. Lib., 15, 122 (1954)]. The bulky substituents employed in the present work were the t-butyl and trimethylammonium groups.

Investigated at 75° were the competitive bimolecular substitution and elimination reactions of potassium t-butoxide with N,N,N-trimethylcyclohexylammonium chloride, cis-, and trans-4-t-butyl-N,N,N-trimethylcyclohexylammonium chloride, which were prepared from the corresponding primary amines. Bimolecular substitution should produce an N,N-dimethylcyclohexylamine plus t-butyl methyl ether. Bimolecular elimination would yield a cyclohexene plus trimethylamine. The amine fraction of the product, isolated as the hydrochloride, was analyzed by infrared spectroscopy. Under conditions which caused the unsubstituted N,N,N-trimethylcyclohexylammonium chloride to react to give 93% substitution and 7% elimination, the trans-4-t-butyl compound gave a quantitative yield of substitution product while the cis- isomer gave 92% elimination plus 8% substitution.

The results, which are interpreted in terms of the energy differences arising from repulsive, non-bonded group interactions in the elimination transition states, provide an example of control of the course of a reaction by the axial effect.

The change of base and solvent from potassium t-butoxide in t-butyl alcohol to potassium hydroxide in water resulted in a marked decrease in the rate of elimination and substitution. N,N,N-trimethylcyclohexylammonium chloride was recovered in 97% yield after treatment with 1 N potassium hydroxide at 75° for 3.5 hours.

The synthesis of cis-4-t-butylcyclohexylamine from cis-4-t-butylcyclohexanecarboxylic acid in 90% yield by the Schmidt reaction is described.

Part II. A Quantitative Relationship Between Dissociation Constants and Conformational Equilibria

The equation $K_R = (A)/(E) = (K-K_e)/(K_a-K)$ expresses the relationship between the dissociation constant K and the conformational equilibrium constant K_R of a molecule which can be considered to exist in two readily interconvertible conformations A and E, having the specific dissociation constants K_a and K_e, respectively. The relationship is analogous to that connecting the rate of a reaction and the distribution of the reacting species between two conformations [S. Winstein and N. J. Holness, J. Am. Chem. Soc., 77, 5562 (1955); E. Eliel and C. A. Lukach, Abstr. 130th Meeting Am. Chem. Soc., Atlantic City, p. 34-0 (1956)].

The equation has been derived and applied to the prediction of the dissociation constants of 3- and 4-alkylcyclohexanecarboxylic acids. The calculation upon which the predictions are based involves the simultaneous solution of equations relating the conformational and protonic equilibria of cyclohexanecarboxylic acid, cis, and trans-4-methylcyclohexanecarboxylic acid, and the free energy difference between the two chair conformations of methylcyclohexane. Published data were employed. The conformational equilibrium constants, $K_R = (A)/(E)$ (where A represents the chair conformation of the cyclohexane ring in which the carboxyl group is axial, and E, equatorial), calculated for the above acids at 25°, are 0.06, 1, and

0.003, respectively. The method provides an additional approach to the problem of quantitative conformational analysis.

cis- and trans-4-t-Butylcyclohexanecarboxylic acid have been prepared and their dissociation constants have been determined in 66% dimethylformamide. The apparent pK_a values are 8.16 and 7.73, respectively.

The apparent pK_a values of cis- and trans-4-t-butylcyclohexylamine hydrochloride, determined in 66% dimethylformamide, are 10.27 and 10.35, respectively.

145 pages. $2.00. Mic 57-1200

THE MECHANISM OF THE ISOMERIZATION OF D-GLUCOSE BY A STRONG BASE ANION EXCHANGE RESIN

(Publication No. 20,763)

Robert Richard Thompson, Ph.D.
Washington University, 1957

Chairman: John C. Sowden

Although the complex action of alkali on the reducing sugars has been under investigation for more than one hundred years, many of the reaction mechanisms, products and associated effects are still unknown or not determined. It was in order to clarify some aspects of this fundamental problem that a study of the mechanism of formation of (DL+D)-sorbose from the action of a strong base anion exchange resin on D-glucose was undertaken. Also, the presence of L-fructose in the unfermentable fraction from this reaction was to be verified.

Carbon-14 labeled D-glucose was utilized in the study of the mechanisms responsible for the formation of the D- and L-sorbose. (DL+D)-Sorbose was isolated from the unfermentable fraction of the reaction products from the action of Amberlite IRA-400 resin on a 20 percent solution of D-glucose-1-C^{14}. The sorbose phenylosotriazole derivatives were resolved by routine crystallization and the distributions of radioactivity in the D-, the DL-, and the L-compounds were determined by degradation and radioassay.

The idenfitication of L-fructose as a component of the unfermentable fraction was accomplished by isolating it as its phenylosotriazole derivative after first destroying the aldose content of this fraction.

Until the present time, it was believed that a process of fragmentation followed by recombination of fragments was the principal route involved in the formation of sorbose (and certain other products) by the action of base on D-glucose or D-fructose. However, the present experimental results show that only a minor part of the sorbose is formed in this manner whereas the principal process by which the sugar is formed involves the formation of an enediol and successive isomerizations of this function throughout the carbon chain. In this manner, the 3,4- and 4,5-enediols are eventually formed, allowing the inversions of configuration necessary for the production of D- and L-sorbose, L-fructose and probably all the other hexose sugars. 63 pages. $2.00. Mic 57-1201

CHEMISTRY, PHYSICAL

EFFECT OF DEGREE OF ACETYLATION ON MECHANICAL PROPERTIES OF CELLULOSE ACETATE FILMS

(Publication No. 20,268)

Adnan Husayn Awni, Ph.D.
Virginia Polytechnic Institute, 1956

Four samples of cellulose acetates having degrees of combined acetic acid between 50.8 - 55.8% were processed to obtain sharp fractions of approximately the same degree of polymerization. About 2000 grams starting material of each sample of cellulose acetate were needed to obtain approximately 50 grams of sharp fraction for testing the mechanical properties of their films.

Fractionation of the cellulose acetate was from an acetone-water mixture, by addition of n-heptane. After a series of refractionations a sharp fraction of each of the four cellulose acetates resulted. These fractions had different degrees of acetylation but approximately the same degrees of polymerization. Each fraction was then dissolved in acetone and cast into a film which was conditioned for three days and the mechanical properties were determined in an attempt to determine the effect of degree of acetylation on the mechanical properties.

It was found that the degrees of acetylation of the various sharp fractions of cellulose acetates under investigation had no measurable effect on the mechanical properties of their films.

Several possible explanations for the lack of variation in mechanical properties with the degree of acetylation are the following:

1. It is possible that the degrees of polymerization of the various fractions are so high that the forces of cohesion between the chains are great. Hence, during mechanical testing, rupture of the chains occurs in all cases and the mechanical properties of all the fractions would be the same and independent of the degree of acetylation.
2. It is also possible that if fracture of the films is caused by slipping of the chains along each other, then the force necessary to overcome the secondary valence forces holding the chains together is so great that the effect of the degree of acetylation on it could not be detected by the methods of measurement available. This means that it is possible that the effect of the high degree of polymerization of the fractions on mechanical properties is high enough to overshadow the effect of the degree of acetylation.
3. It is also possible that the range of the degree of acetylation in the fractions under investigation is not large enough to give appreciable changes in the mechanical properties of the various fractions.
4. It is possible that the sensitivities of the machines used for mechanical testing are not high enough to detect changes in the mechanical properties of the various fractions due to variations in the degree of acetylation.

Of the explanations offered above the most probable appears to be "1" and it is therefore concluded that at a degree of polymerization of 300 the force required to rupture a film has reached the value required to rupture a C - O - C bond and is independent of the secondary valence forces and so not affected by variation in the degree of acetylation.

It was found that the degrees of polymerization of

various samples of cellulose acetates determined by the cupriethylenediamine viscosity method were almost four times greater than the degrees of polymerization of the same samples determined by the acetone viscosity method using constants obtained from the literature. It was also found that the degree of polymerization of a sharp fraction determined by the light scattering method was in good agreement with the degree of polymerization of the same sharp fraction determined by the cupriethylenediamine viscosity method. It is concluded that a considerable variation exists in the degree of polymerization as determined by various methods but that for purposes of comparison of the properties any one method is satisfactory until the reason for such difference be found.

116 pages. $2.00. Mic 57-1202

HINDERED INTERNAL ROTATION IN HYDROGEN PEROXIDE

(Publication No. 20,369)

George Earl Blomgren, Ph.D.
University of Washington, 1956

An introductory discussion of the general problem of internal rotation is presented in simplified terms with reference to the hydrogen peroxide molecule as an example. There follows a critical discussion of the current status of the problem of hindered internal rotation in hydrogen peroxide. Some new interpretations of the data available from the absorption spectra in the 1 μ region and in the microwave region are made in order to bring previously obtained results into closer agreement. It is assumed that there is no observable splitting due to hindered internal rotation in the absorption region at 1 μ and an identification of some intense peaks is made which implies the presence of two overlapping bands, with a distance of 16.0 cm^{-1} between band centers. Two microwave lines are assigned to the first excited torsion state and a calculation based on this assignment and utilizing a simplified potential function results in a barrier to internal rotation in agreement with the new interpretations of the 1 μ absorption. Better agreement with theoretical barrier height calculations and with the location of the torsional fundamental are also obtained.

A solution of the wave equation applicable to the low unequal barrier model and a derivation of the selection rules for vibration-rotation transitions are presented in appendices. Also, the remeasurement of an absorption band in the 1.4 μ region and the resulting data are presented in an appendix. No satisfactory analysis of this band was obtained because of the intense absorption of atmospheric water in this region.

118 pages. $2.00. Mic 57-1203

REACTIONS AT A MOVING INTERFACE RATE OF FREEZING

(Publication No. 20,042)

Donald Fred Clifton, Ph.D.
University of Utah, 1957

Chairman: Henry Eyring

A method for investigating the kinetics of reactions at moving interfaces is developed in thermodynamic form.

A reaction which results in a phase change is accompanied by the formation of a high free energy interface between regions having different structures. The reaction is confined to the interface. Any energy or composition changes accompanying the reaction necessitate transfer processes in the unstable phase which is the source or sink for these processes. The linear rate of advance of the interface as a function of the state of the unstable phase is the usual experimental measurement made in studying the kinetics of moving interface reactions.

The chief problem in studying the rates of these reactions is to determine how the available driving force is distributed between the reaction and the transfer processes. A general method of attack is developed which allows considerable freedom of choice of data to be used in evaluating the rate parameters. The method employed uses the data chosen efficiently.

In the steady state the rates of the processes are equal. A set of simultaneous equations thus exists in which the rate of each process can be expressed as a function of the change in the value of an intensive parameter across the region in which the process takes place. The total of these intensive parameter differences is the difference between the actual state of the unstable phase and its state when in equilibrium with the second phase. Using the thermodynamic relations between the state of a phase and its free energy the rates of the processes can be expressed in terms of free energy differences. The precipitation of a second phase from a supercooled solid solution in a two component system is discussed as a qualitative example of the application of the above relations.

One of the greatest difficulties in solving for the rate parameters of the solid-liquid transformation is the lack of knowledge of the exact shape of the growing crystal surface. This shape must be known in order to solve for the temperature difference between the solid and the melt necessary for removal of the latent heat of fusion and the difference between the solid surface temperature and the equilibrium temperature necessary to supply the driving force for the transformation. The total supercooling is thus expressible as the sum of two terms, the temperature difference necessary to remove the latent heat of fusion and the temperature difference necessary to supply the driving force for the reaction. These temperature differences can be expressed in terms of the linear freezing velocity, the supercooling, an unknown parameter in the reaction rate equation, and an unknown parameter in the heat flow equation. An equation is derived expressing the unknown heat flow parameter as a function of the other three. The unknown parameter in the reaction rate equation is the product of the transmission coefficient and the exponential term containing the activation free energy.

The literature on crystal growth which pertains to the calculations made in the thesis is reviewed. Calculations

are made using published data on water, yellow phosphorus, and tin and newly obtained data on gallium and bromine.

The product $\mathscr{H}$ exp ($-\Delta F^*/RT$) is found to be quite certainly larger for yellow phosphorus than for water or tin. The value of this product is probably smaller for gallium and for bromine than for water and tin. The maximum possible activation free energy for yellow phosphorus is found to be less than 3500 cal/mole. Since a part of the supercooling must be needed to furnish a temperature gradient to remove the latent heat of fusion and the transmission coefficient is probably less than unity, the actual value of the activation free energy is certainly appreciably less than this maximum. The free energy of activation for freezing is thus less than the activation free energy for viscous flow which is 3660 cal/mole at the melting temperature. The value of $\mathscr{H}$ exp ($-\Delta F^*/RT$) for H_2O and Sn_4 is probably about 1/20 that for P_4. Steric effects appear to account for a large part of this difference.

92 pages. $2.00. Mic 57-1204

AN INVESTIGATION OF ENZYME-SUBSTRATE AND ENZYME-COMPETITIVE-INHIBITOR COMPLEXES FOR THE SYSTEM alpha-CHYMOTRYPSIN, N-BENZOYL-ortho-NITRO-L-TYROSINE HYDROXAMIDE, AND N-BENZOYL-ortho-NITRO-L-TYROSINE

(Publication No. 19,554)

Erwin Morton Cohen, Ph.D.
Northwestern University, 1956

Supervisor: Irving M. Klotz

Although the exact mechanism of enzyme catalysis is unknown, it has been established that an intermediate complex forms between the enzyme and the substrate prior to formation of the products.

It was the purpose of this research to study the formation of a complex between the enzyme alpha-chymotrypsin (1) and N-benzoyl-ortho-nitro-L-tyrosine (2) by three independent methods (kinetics, equilibrium dialysis, and spectroscopy) to determine the nature of and to develop methods for further study of the complex.

The kinetic technique employed the substrate N-benzoyl-ortho-nitro-L-tyrosine hydroxamide (3) which is hydrolyzed in the presence of (1) to hydroxylamine and (2). The kinetic technique also employed (2) as a competitive inhibitor. The rate of hydrolysis of (3) was determined by the addition of $FeCl_3$ which forms a colored complex with hydroxamic acids. The equilibrium dialysis and spectroscopic methods both employed (1) and (2). The highly chromophoric nature of (2) was ideal for its spectroscopic analysis.

It was possible to evaluate the stability constant for the complex formed between (1) and (2) by both equilibrium dialysis and kinetics. The values of the stability constants were 3.68 ($\pm$ .37) x 10^2 M^{-1} and 3.08 ($\pm$ .31) x 10^2 M^{-1} as determined by kinetics and equilibrium dialysis respectively in .025 M THAM and 0.15 M NaCl buffer at pH 6.8 at 20° C. The stability constant dropped to 1.43 ($\pm$ .14) x 10^2 M^{-1} when the pH was raised to 7.2. ΔH^0 and ΔS^0 were determined at pH 7.1. These values are -12.6 Kcal.-$mole^{-1}$ and -32.9 E.U. for the formation of the complex from (1) and (2). Spectra were obtained from 320-480 mu for solutions of (1) and (2) separately and when mixed together. Comparison of the spectra obtained indicated the presence of a complex formed between (1) and (2).

A mechanism for the enzymatic property of alpha-chymotrypsin which also explains the decrease in binding of competitive inhibitors of the carboxylic acid type with increase in pH is believed to involve a histidyl residue of the enzyme and two other groups as yet not determined, but which are believed to contribute to the binding through Van der Waals' forces. When the histidyl group is charged ($pK_a \sim 6.8$) the enzyme is inactive but carboxylic acid inhibitors are strongly bound. When the histidyl residue is uncharged the enzyme is active but the binding of carboxylic acid inhibitors decreases markedly. The values for the stability constant as determined by both the kinetic and equilibrium dialysis methods agree within experimental error although the higher value obtained by the former method may be due to a ternary complex formed between the enzyme, the substrate, and the inhibitor. Certainly the values are close enough to suggest that more frequent use should be made of the equilibrium dialysis method for investigation of enzyme mechanisms, particularly when the kinetic technique is unsuitable such as with alpha-chymotrypsinogen and DFP-alpha-chymotrypsin.

128 pages. $2.00. Mic 57-1205

HYDROGEN BOND SYSTEMS — TEMPERATURE DEPENDENCE OF OH FREQUENCY SHIFTS AND OH BAND INTENSITIES

(Publication No. 20,358)

Jack N. Finch, Ph.D.
Kansas State College, 1957

Considerations from a one-dimensional model of OH---O hydrogen bonding predicted that the bonded OH frequency would shift in position and change in intensity with a change in temperature. The purpose of this research was to obtain frequency and integrated intensity data for the bonded OH fundamental frequency at various temperatures and concentrations to test these predictions.

Band center frequency and intensity was obtained at 5° to 10° intervals between 200° and 300°K for methyl, ethyl, isopropyl, n-butyl, isoamyl and n-hexyl alcohols in the liquid state. The band center frequency for the bonded OH frequency was found to decrease linearly with decreasing temperature. The intensity increased linearly with decreasing temperature. The change in frequency was as much as 50 cm^{-1} for which the hydrogen bond model predicts that the O---O distance was decreased 0.025Å and the hydrogen bond energy has increased by about 0.4 kcal. The increase in intensity in the temperature interval was as much as 70 per cent. The change in intensity suggested that in liquids the coupling between vibrations might be appreciable and result in a different probability for an upper stage transition for different temperature-dependent populations of the other vibrations. The increase in intensity is possibly due to the force field in which the molecule is located. The force field is a function of solvent molecular

motion, (i.e., of the temperature) and may alter the matrix elements association with a given transition. Another explanation is that the (-)$\dot{O}$ H —— $\dot{O}^{(\pm)}$ structure of the hydrogen bond becomes more important at low temperatures with the result that the change in dipole moment with respect to the OH distance is increased and consequently the intensity is increased.

Compounds capable of both inter- and intra-hydrogen bonding were investigated. For both o-chlorophenol and 2-methyl-4-methoxy-2-pentanol, the intra-bonded frequency remained constant in position and intensity while the inter-bonded frequency decreased linearly in frequency and increased linearly in intensity with decreasing temperature.

Band center frequency and intensity for concentrated solutions of n-hexyl alcohol and phenol in carbon disulfide and isopropyl alcohol in diethyl ether showed the same linear relationship with temperature. Both quantities were affected by the interaction of solvent and solute.

Concentration dependence studies of isopropyl alcohol in solvents of different basicity were conducted. It was found that the band center frequency for the associated band of isopropyl alcohol in carbon tetrachloride shifted little. For similar solutions in diethyl ether and triethylamine the frequency shift was +168 cm^{-1} and -94 cm^{-1}, in the concentration interval 13.06 to 0.01 molar.

The intensity for the above solutions was nearly independent of concentration in the interval 2.0 to 13.06 molar. With continued dilution below 2.0 molar, the intensity of the isopropyl alcohol solution in carbon tetrachloride decreased to a limit which was identical with the accepted value of its true intensity. The intensity of solutions of isopropyl alcohol in diethyl ether or triethylamine rapidly increased with continued dilution until accepted values for the true intensity in respective solvents was reached.

The change in intensity for solutions of isopropyl alcohol in carbon tetrachloride has been explained in terms of the inert behavior of the solvent. Two explanations have been offered for the intensity increase and shift in frequency with increasing dilution for the isopropyl alcohol solution in diethyl ether or triethylamine. The first suggested the existance of alcohol-solvent hydrogen bonds having different bond energies and intensities. The second suggested a change in the size of the polymer aggregate by reaction with the solvent. 132 pages. $2.00. Mic 57-1206

CATALYTIC STUDIES ON EVAPORATED METAL SURFACES

(Publication No. 18,699)

John Gerald Foss, Ph.D.
University of Utah, 1956

Chairman: Dr. Henry Eyring

A brief review of the literature pertaining to evaporated metal films and catalysis is presented. This is followed by a discussion of the experimental techniques used in this study.

The hydrogenation of ethylene over evaporated nickel surfaces is zero order in ethylene and first order in hydrogen for pressures of 0.03 to 300 mm. The activation energy for the reaction is 8 kcal. The results obtained are compared with those of previous studies. Methods of stabilizing the metal films are presented.

The mechanism of the reaction is discussed and it is concluded that because of the slight differences between the two mechanisms now in dispute it is not possible to distinguish between them with the data now available. Furthermore there does not seem to be any practical way of trying to do so at present.

The final section is a theoretical discussion dealing with the relationship between heats of adsorption and activation energies observed for intermediate order heterogeneous catalysis. A number of precautions which should be observed in determining experimental activation energies are discussed. An application of the equations derived is made to the specific case of ammonia decomposing on tungsten. 80 pages. $2.00. Mic 57-1207

STRAIN ELECTROMETRY

(Publication No. 20,353)

Albert Gail Funk, Ph.D.
University of Utah, 1956

Supervisor: Henry Eyring

A study of the electrical effects caused by the plastic deformation of copper wire in aqueous solutions is reported. The deformations of the wire were effected in various solutions in order to study the nature of the chemical reactions which are responsible for the potential. Results are reported which involve the range of pH values from 0 to 13. Measurements were made in solutions containing several other substances, particularly those containing a constituent which will complex with copper. Included were salts containing Cl^- and $C_4H_4O_6^=$, as well as ammonia and pyridine. Further, results were obtained for copper salts, which, in certain instances, contribute a common-ion to the reaction. The effects of O_2, H_2, and A were obtained by bubbling the gas through the solution.

With the above reagents, the experiments were devised so as to isolate certain of the important variables. Thus the amount of strain was varied in one set of experiments while the chemical constitution of the solution was kept constant. The chemical composition of the solution was then varied, first by using different constituents, then by changing the concentrations involved over a wide range. Further information on the chemical reactions is found by means of varying the potential difference between the wires, keeping both the strain and composition constant. This is done, firstly, by varying the resistance of the external circuit. The usual value of this quantity is 10^7 ohms. At smaller resistances, a large part of the discharge occurs through the external circuit, and smaller voltages are obtained. Secondly, the capacitance of the system can be increased through the use of an external capacitor in parallel with the circuit. As the capacitance is increased, the potential is decreased, and the reaction rates change in a manner depending upon their potential dependence.

In distilled water, the electrode which is plastically strained acquires a negative charge with respect to the

reference electrode. A sudden charging gives a potential of about 50 mv., followed by a decay with a half-life of about one second. Variations on this are found in different solutions. The maximum potential and half-life both increase with pH over the range from 2 to 12. This is accentuated in acids to the extent that a small negative potential is followed by a large positive value, before the decay process leads back to the reference value. For those substances that complex with copper, an increase of potential with concentration is usually found to begin with, followed by a cecrease at higher concentrations. Increasing concentrations of copper salts, with non-complexing negative ions, lead to decreasing voltages over the concentration range measured. Modifications on this general pattern are caused by bubbling O_2, H_2, and A through the system.

The results have been interpreted in terms of positive- and negative-charging surface reactions. The plastic deformation seems to (1) rupture the ubiquitous oxide film, and (2) active certain surface atoms such that reaction can easily occur. The potential is a result of several basic reactions. Thus the formation of copper ions from activated, or "strained," surface atoms leads to a negatively-charged wire, while the reverse association reaction charges positively. In addition, the formation of complexes, both on and away from the surface, leads to potential changes, as does simple ion adsorption. The reactions which account for the pH behavior of the potential are *

$$Cu + HOH \longrightarrow Cu - O\begin{matrix}H\\H\end{matrix},$$

$$Cu^* - O\begin{matrix}H\\H\end{matrix} + OH^- \longrightarrow Cu^* - OH + HOH + \epsilon,$$

and

$$Cu^* - O\begin{matrix}H\\H\end{matrix} + \begin{matrix}H\\H\end{matrix}O + 2\epsilon \longrightarrow \begin{matrix}Cu^* - OH\\Cu^* - OH\end{matrix} + 2\,OH^-.$$

It has been found, as a general principle, that any reagent causing a positive charge to develop on the wire in its resting state, will decrease positively-charging reaction rates, and increase negatively-charging reaction rates. The reverse is true if the resting state is negative. This explains the results obtained with O_2, NaOH, and NH_4OH in the immersion solutions.

84 pages. $2.00. Mic 57-1208

The symbol "Cu" represents a copper atom of high internal energy.

GAS PHASE REACTIONS ACTIVATED BY NUCLEAR PROCESSES

(Publication No. 20,624)

Adon Alden Gordus, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor John E. Willard

An investigation of gas phase reactions of alkanes with energetic halogen atoms activated by the (n,γ) process and by isomeric transition has been carried out with the purpose of extending the information on this unique type of reaction and learning more about the mechanism.

Various halogen compounds in an excess of CH_4, C_2H_6, C_3H_8, and C_4H_{10} were irradiated in the nuclear reactor of the Argonne National Laboratory. The fraction of the total radioactive halogen formed by the (n,γ) process which entered organic combination was determined. These organic yields were found to be independent in general of the form of molecular combination of the halogen used as the source compound. The reaction of I^{128} resulted in an organic yield of about 50 per cent with CH_4 and of 2 to 5 per cent with C_2H_6, C_3H_8, and n-C_4H_{10}. Br^{80} atoms gave a yield of 18 per cent with CH_4, and 10 per cent with C_2H_6, C_3H_8, and n-C_4H_{10}. The yields for Cl^{38} atoms were 17 per cent with CH_4 and 10 per cent with C_2H_6.

Gas chromatography techniques were utilized in characterizing the organic iodides and bromides formed in these (n,γ) reactions. Detection was by means of radioactivity. Although a variety of organic products was formed, it appeared that no products resulted with a carbon content greater than that of the alkane present in the reaction mixture; methyl halide always appeared as one of the major products.

Gaseous mixtures of various compounds containing Br^{80m} in an excess of methane were prepared. The fraction of the Br^{80} atoms (formed by the $Br^{80m} \xrightarrow{I.T.} Br^{80}$ reaction) which reacted with the methane was determined. These organic yields were 8 per cent when the Br^{80m} was in the form of CCl_3Br, Br_2, or $CHBr_3$, 4 per cent when as CH_3Br, 3 per cent when as C_2H_5Br, and zero per cent when as HBr. This dependence of the organic yield on the form of molecular combination of Br^{80m} is discussed in terms of a possible dependence of the initial kinetic energy of the Br^{80} atom on its radical partner.

Experiments to determine the fraction of the $Br^{80m} \xrightarrow{I.T.} Br^{80}$ events which fail to rupture the $C - Br^{80}$ bond when Br^{80m} is in the form of an organic bromide were carried out using a variety of techniques. The most rigorous techniques gave somewhat lower values than previously observed but were in agreement with the conclusion that failure of rupture may be greater for bromides dissolved in liquid bromine than for gaseous bromides.

Preliminary experiments on the gas phase reaction of energetic tritons formed by the $He^3(n,p)T^3$ reaction in an excess of CH_4, C_2H_6, and C_3H_8 are reported.

168 pages. $2.20. Mic 57-1209

THE KINETICS OF OXYGEN EXCHANGE BETWEEN PHOSPHORIC ACID AND WATER

(Publication No. 20,755)

Bernard Keisch, Ph.D.
Washington University, 1957

Chairman: Arthur C. Wahl

The work in the field of oxygen exchange reactions between water and inorganic oxy-anions has been studied largely only in a qualitative way. Only for a few cases has the kinetics of the exchange been studied in detail.

The rate of exchange of oxygen between phosphoric acid and water has been studied in the concentration range 6 to 18.3 F H_3PO_4. Half-times of approximately 250 to 0.3 hours were obtained at 100° in this range. The rate of exchange was found to increase with phosphoric acid concentration continuously and rapidly in this range, and an empirical rate law involving the activities of the species present is proposed. The rate law was determined at 100° C and may be written:

$$R = k_1 a_{H_2O} a_{H_3PO_4} + k_2 a_{H_2O} a_{H_4P_2O_7} + k_3 a_{H_2O} a_{H_5P_3O_{10}} .$$

Other rate measurements were made at various temperatures giving activation energies varying from 26,500 cal/mole in 8.8 F H_3PO_4 to 19,700 cal/mole in 17.8 F H_3PO_4.

The first term of the empirical rate law predominates at low concentrations and is shown to be consistent with a mechanism involving penta-coordinated phosphorus as an intermediate.

The second term predominates at high phosphoric acid concentration and can be interpreted as being the result of hydrolysis and reformation of pyrophosphoric acid. Measurements of the hydrolysis rates at 25 and 60° C support this interpretation.

The third term is relatively unimportant, contributing appreciably only at the highest phosphoric acid concentrations, and since the rate data at these concentrations are less precise than those at lower concentrations the evidence for the third term is weak. However, it does have a form that can be interpreted as deriving from the reasonable mechanism of hydrolysis and reformation of tripolyphosphoric acid.

The exchange of oxygen between phosphoric acid and water was followed by adding O^{18}-enriched water to phosphoric acid of normal O^{18} abundance, and then following the decrease of O^{18} concentration in the water. An electrolysis method for measuring the amount of O^{18} present in the water in phosphoric acid solutions is described. An isotope dilution technique for determining the concentration of water in concentrated phosphoric acid solutions is also described. With this method the amount of pyrophosphoric acid present is obtained indirectly.

71 pages. $2.00. Mic 57-1210

SOME ASPECTS OF CHROMATOGRAPHY

(Publication No. 20,043)

Roy Alan Keller, Ph.D.
University of Utah, 1956

Chairman: Henry Eyring

Paper consists of crystalline and amorphous regions, the latter having unsatisfied dipole bonds (primary sites) capable of adsorbing materials. If they adsorb water they become partition sites and this water becomes the immobile phase of liquid-liquid partition chromatography. Treating the immobile phase as a liquid gel, Crystal Violet, Malachite Green, and Basic Fuchsin were chromatographed with absolute ethanol, 95 per cent ethanol, and 50 per cent ethanol, and differences in chromatographic behavior explained on the basis of the degree of dehydration of this gel. Retention at the origin was explained by this same model. Insufficient immobile phase leads to non-linear adsorption isotherms and tailing solute spots. Sufficient water in the paper and developer decreases retention at the origin and produces ideal chromatograms.

Vapor phase chromatography is compared with liquid-liquid partition chromatography and thermodynamic properties indicated which may be useful in predicting separations.

Anomalies may result if there is too little immobile phase present and it is suggested that these may be treated as if only part of the molecules dissolve in the immobile phase. 110 pages. $2.00. Mic 57-1211

A STEREOCHEMICAL STUDY OF THE FORCES EXISTING BETWEEN ELECTROSTATICALLY CHARGED GROUPS IN THE SAME MOLECULE AND THE USE OF DIMETHYLFORMAMIDE IN THE ULLMANN REACTION

(Publication No. 19,416)

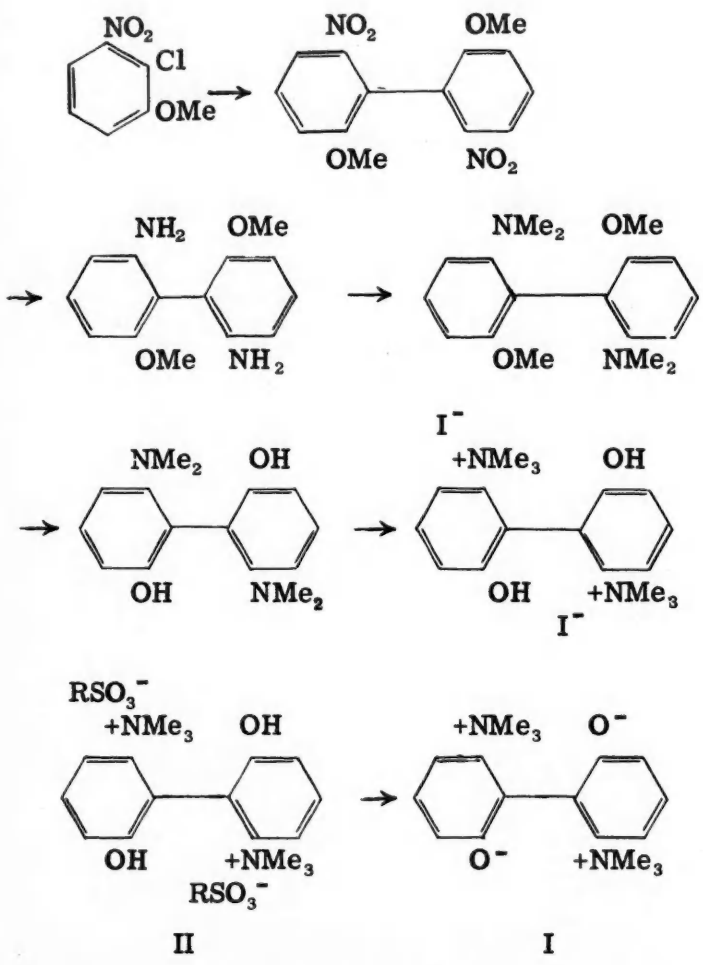
David L. Kendall, Ph.D.
Purdue University, 1956

Major Professor: Nathan Kornblum

Although considerable importance is attached to the role which electrostatic charges play in determining the properties of organic compounds comparatively little is known about the magnitude of such effects. The present investigation is a stereochemical study of the forces between charged groups in the same molecule.

From steric considerations it is clear that the betaine I should exist in optically stable forms. However, in I there are also present electrostatic attractions which will act so as to force the molecule into the optically inactive, planar, conformation. It was, therefore, of considerable interest to see if I could be obtained optically active and, if so, to establish the resistance to racemization of this compound.

The following sequence gave the betaine I.



II I

RSO_3^- - d-Camphorsulfonate

Resolution was achieved via the d-camphorsulfonate salt II. The active d-camphorsulfonate, II, on passage through a column of Amberlite IR-4B ion exchange resin gave active I $\alpha_D^{27} + 0.41^0$, 1 - 2, c - 1, H_2O; $[\alpha]_D^{27} + 21^0$.

An aqueous solution of I undergoes no loss in optical activity after standing one week at room temperature; nor is there any diminution in activity after the water solution of I is held at 80^0 for fifteen minutes. It is clear, then, that in this particular molecule the electrostatic forces are not sufficient to overcome the steric repulsions of the bulky ortho substituents.

The second part of this thesis is concerned with a modification of the Ullmann reaction. The use of dimethylformamide as a solvent, in place of the commonly employed nitrobenzene, results in distinctly improved yields in the Ullmann reaction. It should be emphasized, however, that in those instances where the usual procedure fails completely, the use of dimethylformamide also fails. The results obtained with a number of halides have been published in the J. Am. Chem. Soc., 74, 5782(1952).

91 pages. $2.00. Mic 57-1212

I. THE ANALYSIS OF URANYL OXALATE WITH CERIC SULFATE, USING DIFFERENTIAL ULTRAVIOLET SPECTROPHOTOMETRY. II. PHOTOCHEMICAL DECOMPOSITION STUDIES ON THREE TRIMETHYLENE OXIDES, AND THE FREE RADICAL INITIATED DECOMPOSITION OF TRIMETHYLENE OXIDE.

(Publication No. 19,015)

J. David Margerum, Ph.D.
Northwestern University, 1956

Part I

The technique of differential spectrophotometry with ceric sulfate was applied to the analysis of uranyl sulfate-oxalic acid solutions. These uranyl oxalate solutions were analyzed by adding them to a slight excess of ceric sulfate solution, adding dilute sulfuric acid, diluting to a large volume, and measuring the differential absorption versus standard ceric sulfate solutions.

It was shown that this ceric sulfate method can be applied to the analysis of uranyl oxalate actinometry solutions. It was calculated that these analyses were equivalent to measuring the decomposition of 6×10^{-5} moles of oxalate, with a relative error of about 3 percent. Thus with just ordinary volumetric techniques this method compares favorable with the more difficult $KMnO_4$ method of Forbes and Leighton.

Part II

The following studies were carried out: Vacuum ultraviolet spectra of trimethylene oxide, and of 1,1-dimethyltrimethylene oxide; Thermal decomposition of trimethylene oxide vapor, initiated by methyl radical attack; Rate of formation of products from trimethylene oxide vapor photolysis, as a function of temperature; Trimethylene oxide photolysis in isooctane solution, in aqueous solution, and as a pure solid at -196^0; Photolysis of 1,1-dimethyltrimethylene oxide vapor at 25^0; Photolysis of 1-phenyltrimethylene oxide in isooctane solution.

It was shown that methyl radical attack on trimethylene oxide leads to a partial decomposition into C_2H_4, CO, H_2 and CH_2O. The mechanism of this decomposition is believed to be the dissociation of a cyclo-C_3H_5O radical into C_2H_4 and $\cdot HCO$, following abstraction of an α-hydrogen from trimethylene oxide by methyl radicals.

Photolysis studies on trimethylene oxides were made with an unfiltered mercury arc. The radiation causing the decomposition was shown to be in the 2000A region. The products of vapor phase trimethylene oxide photolyses consisted of about 90% C_2H_4 and CH_2O, about 9% CO and H_2, and less than 1% C_2H_6 and CH_4. The rates of product formation were found to be nearly independent of temperature between 25^0 and 100^0, but increased by about 25% between 100^0 and 150^0. This increase in rates of formation of products is believed to have been caused by radical initiated, thermal decomposition of trimethylene oxide. Probably all of the CO and H_2, and perhaps some of the C_2H_6 and CH_4 was the result of, directly or indirectly, secondary photolysis of CH_2O. The direct intramolecular decomposition of trimethylene oxide into ethylene and formaldehyde is regarded as being the predominant primary process of photolysis. It appears to account for at

least 98% of the trimethylene oxide decomposition. Irradiation of trimethylene oxide under greatly variant conditions of temperature and physical state gave essentially the same products in each case. It is indicated that if the intramolecular decomposition involves a biradical intermediate, this biradical would have to be very short lived.

1,1-Dimethyltrimethylene oxide vapor irradiation produced C_2H_4, CH_3COCH_3, iso-C_4H_8, CH_2O, CH_4, C_2H_6, CO and H_2. Two main intramolecular type primary processes are considered as having occurred, a dissociation into C_2H_4 and CH_2COCH_3 and into iso-C_4H_8 and CH_2O. The other products came from secondary photolysis of acetone and formaldehyde. The ratio of C_2H_4/iso-C_4H_8 was 1.2/1.0.

CH_2O and C_2H_4, in the ratio 3.5/1.0, were found in the photolysis products of 1-phenyltrimethylene oxide solution. This is considered to be indicative of two intramolecular primary processes, one a decomposition into CH_2O and styrene, and the other a decomposition into C_2H_4 and benzaldehyde. 118 pages. $2.00. Mic 57-1213

MECHANISM OF BASE HYDROLYSIS OF SOME COBALT(III) COMPLEXES

(Publication No. 19,061)

Robert Eldon Meeker, Ph.D.
Northwestern University, 1956

The mechanisms of base hydrolysis and of acid hydrolysis of some coordination complexes such as chloropentamminecobalt(III) chloride, $[Co(NH_3)_5Cl]Cl$, have been subject to controversy.

This dissertation presents strong evidence that the acid hydrolysis proceeds by a simple SN1 dissociation mechanism, as shown in equations 1 and 2, and that the base hydrolysis proceeds by an SN1CB mechanism in which the rate-determining step is the dissociation of a chloride ion from the conjugate base of the complex ion, as shown in equations 3 through 5.

(1) $[Co(NH_3)_5Cl]^{++} \xrightarrow{slow} [Co(NH_3)_5]^{+++} + Cl^-$

(2) $[Co(NH_3)_5]^{+++} + H_2O \xrightarrow{fast} [Co(NH_3)_5H_2O]^{+++}$

(3) $[Co(NH_3)_5Cl]^{++} + OH^- \overset{fast}{\rightleftharpoons} [Co(NH_3)_4NH_2Cl]^{+} + H_2O$

(4) $[Co(NH_3)_4NH_2Cl]^{+} \xrightarrow{slow} [Co(NH_3)_4NH_2]^{++} + Cl^-$

(5) $[Co(NH_3)_4NH_2]^{++} + H_2O \xrightarrow{fast} [Co(NH_3)_5OH]^{++}$

The base hydrolysis reaction is ordinarily much too rapid for kinetic study by conventional techniques. Half-times are typically only fractions of a second. A simple flow apparatus using electrical conductivity measurements is described for the kinetic study of these fast reactions.

Rates of acid and base hydrolysis are reported for a large number of complexes of cobalt(III). The effect of various structural modifications in the complex molecule on reaction rate is consistent with the mechanisms proposed above. Both steric and inductive factors are considered in the interpretation of the data.

Acid dissociation constants for several related complexes are reported, and these acidities are consistent with the SN1CB mechanism for base hydrolysis. Complexes without acidic protons, where reaction 3 cannot occur, hydrolyse at rates which are independent of pH.

The rate of the base hydrolysis reaction in buffer solutions depends only upon the hydroxide ion concentration, and is not subject to general base catalysis. This result indicates that the rate-determining step is the dissociation of the chloride ion (4) rather than the removal of a proton (3).

A rule for correlating acid and base hydrolysis rates is proposed. "Rates of base hydrolysis should parallel rates of acid hydrolysis for a series of complex ions of cobalt(III) unless a marked change occurs in the acidities of some members of the series."

The rate of aquation has a sharp pH dependence, so that acid hydrolysis rates must be measured in strongly acidic solutions to avoid contributions from the base reaction.

In order to account for the high rates of dissociation of chloroamido and chlorohydroxo complexes of cobalt(III), pi bonding is proposed in which a pair of electrons from a ligand move in to the cobalt, helping to displace the chloro group and helping to stabilize the five-coordinated intermediate which is formed. This internal displacement can occur most readily with electrons from ligands in a position cis- to the dissociating group.

The trigonal bipyramid intermediate has the proper orbital configuration to participate strongly in this pi bonding, but the tetragonal pyramid can participate only weakly. The stereochemical consequences of this are discussed.

114 pages. $2.00. Mic 57-1214

STATISTICAL THERMODYNAMICS OF CONCENTRATED POLYMER SOLUTIONS WITH SMALL ENERGIES OF MIXING AND SOLUBILITY AND DIFFUSION OF FIVE LIQUIDS IN POLYISOBUTYLENE

(Publication No. 20,424)

Eliza Gaston Pollard, Ph.D.
Cornell University, 1956

Part I. Statistical Thermodynamics of Concentrated Polymer Solutions with Small Energies of Mixing. A model is suggested for polymer-diluent mixtures characterized by small energies of mixing. The primary feature of this model is its use of a "surface-fraction" to calculate the number of polymer-diluent contacts in solution. It is assumed that, in solution, only a fraction of the surface of one type of molecule is generally available for contacts with molecules of the second type. The remaining fraction of the surface must be occupied by contacts with molecules identical to the first. Thus the model predicts that clustering will be present in many mixtures. From this model, an expression is derived for the free energy of a polymer-diluent system in concentrated and moderately concentrated solutions. This expression contains two adjustable parameters.

The first parameter, Z, is the ratio between the surface fractions available for 1-2 contacts on the diluent molecule and on the polymer segment. This parameter is predicted to be independent of concentration and of temperature within the ranges ordinarily of interest. The value of the parameter Z gives a measure of the amount of

clustering present in the mixture. If the value of Z differs greatly from V_1/V_2 (the ratio of the molecular volumes of the diluent and polymer segment, respectively), a large amount of clustering exists in the solution. The density of sites available to a type i molecule in solution is not the same as the density of sites available to a type i molecule in the pure component i. The second parameter, χ_1^*, is the free energy of formation of a 1-2 contact. This parameter is also predicted to be independent of concentration in concentrated and moderately concentrated solutions. It is the analog of the parameter χ_1 in the Flory-Huggins equation. When Z is equal to V_1/V_2, the surface-fraction model becomes equivalent to the Flory-Huggins liquid lattice model. In this case Z χ_1^* is equal to χ_1.

From the equation for the free energy, one may calculate the thermodynamic functions of general interest. The theory has been compared with experimental data for polymer solutions with small energies of mixing. Its predictions showed excellent agreement with experimental data on the activity, the heat and entropy of dilution, the clustering function, and the conditions for incipient phase separation. For a given system the parameter Z was independent of both temperature and concentration as predicted, and the parameter χ_1^* was independent of concentration and varied with temperature in the expected manner.

Part II. Solubility and Diffusion of Five Liquids in Polyisobutylene. Kinetic and equilibrium data have been obtained on the sorption of five liquids (benzene, cyclohexane, dioxane, tetrahydropyran, and carbon tetrachloride) by polyisobutylene.

The diffusion obeys Fick's Law, with integral diffusion coefficients increasing exponentially with the volume fraction of diluent. This is explained on the basis of Wilkens' treatment of fluctuations in the free volume.

The equilibrium sorption data obey the predictions of the surface-fraction model. All of the diluents are solvents for polyisobutylene except dioxane, which is a swelling agent. This is also in agreement with predictions of the surface-fraction model.

159 pages. $2.10. Mic 57-1215

THE HEAT OF ADSORPTION OF ARGON ON PRE-ADSORBED XENON LAYERS

(Publication No. 20,395)

Carl Frederick Prenzlow, Ph.D.
University of Washington, 1956

In this thesis, the 71°-81° K adsorption isotherms for argon on P-33 carbon black, on one pre-frozen layer of xenon, and on six pre-frozen layers of xenon are presented. From these isotherms isosteric heat curves, differential entropy curves, and integral entropy curves were calculated.

These data indicate that the simplest monolayer theory of Fowler,[6] based on the Bragg-Williams approximation, was inadequate to explain second layer adsorption of argon on P-33 carbon black.

A first order phase transition was observed for second layer adsorption of argon on P-33 below 68° K. The isotherms in this temperature range showed slightly tilted, though linear, second layer risers. Several reasons for this behavior are advanced.

94 pages. $2.00. Mic 57-1216

6. R. H. Fowler and E. A. Guggenheim, "Statistical Thermodynamics", 425, The Macmillan Company, New York (1939).

ELECTRON EXCHANGE BETWEEN NAPHTHALENE NEGATIVE ION AND NAPHTHALENE

(Publication No. 20,764)

Raymond Leland Ward, Ph.D.
Washington University, 1956

Chairman: Professor S. I. Weissman

The object of this dissertation research was the determination of the rate constants for the electron exchange between naphthalene negative ion and naphthalene. This study was carried out using a paramagnetic resonance technique which did not require, as do most rate determinations, some method of distinguishing reactants from products.

Assuming second order kinetics the rate constants for the systems $Li^+C_{10}H_8^-$, $Na^+C_{10}H_8^-$, $K^+C_{10}H_8^-$ in tetrahydrofuran and $Na^+C_{10}H_8^-$ and $K^+C_{10}H_8^-$ in dimethoxyethane were determined. These values vary between 10^7 liter/mole-sec. and 10^9 liter/mole-sec. An upper limit to the energy of activation has been estimated. The equilibrium constant for the reaction $K^+I^- + Na^+C_{10}H_8^- = K^+C_{10}H_8^- + Na^+I^-$ in dimethoxyethane has been estimated to be 1.5×10^4.

69 pages. $2.00. Mic 57-1217

STUDIES OF THE SOLUBILITY OF WATER IN AROMATIC SOLVENTS USING TRITIUM AS A TRACER

(Publication No. 19,404)

James Wing, Ph.D.
Purdue University, 1956

Major Professor: W. H. Johnston

In the year of 1948, Taylor et al. determined the solubilities of water in various hydrocarbons, using tritium oxide as a tracer. In the year following, Hildebrand developed a semi-empirical formula for the solubility of water in hydrocarbons. In general, this theory is applicable restrictedly to simple non-electrolytes having no polarity.

The present thesis describes the extension of Hildebrand's theory to the more general case including polar and non-polar substances. A parameter due to dipole-dipole interaction was introduced to account for the orientation of the polar molecules. This theory was applied to the solubilities of water in benzene, toluene, and various halogenated benzenes.

Furthermore, the solubilities of water in benzene, toluene, fluorobenzene, chlorobenzene, bromobenzene,

iodobenzene, and o-dichlorobenzene were measured experimentally using an isotopic dilution technique with tritiated water as the tracer. In order to facilitate these measurements, a method was developed for counting tritium in tritiated water. In this method, the water was reacted with calcium carbide and the acetylene was counted with argon in the Geiger region. Various aspects of this method were investigated, including the fractionation of tritium, yields, the quenching properties of acetylene gas, reproducibility, and exchange reactions of acetylene with calcium hydroxide.

The experimental solubilities of water in the aromatic solvents were compared with the extended theory of solubility for polar compounds. A significant improvement over Hildebrand's formula was demonstrated. Some remaining deviation was explained in terms of hydrogen bonding in water and in the organic solvents.

Finally, a literature survey of tritium applications and measurements was made. The procedures for counting tritium were critically reviewed, and the applicability of tritium as a tracer was discussed.

144 pages. $2.00. Mic 57-1218

ECONOMICS, GENERAL

PROGRAMMING GRAIN MOVEMENTS TO DETERMINE OPTIMUM STORAGE LOCATIONS IN NORTH CAROLINA

(Publication No. 20,187)

Ray Verne Billingsley, Ph.D.
North Carolina State College, 1957

Supervisor: Lee Roy Martin

The purpose of this study was to investigate alternatives that would result in improving economic efficiency in the storing of grain in North Carolina with specific reference to locating additional storage. The primary objective of the study was to determine optimum location points for grain storage facilities in North Carolina. The steps in obtaining this objective were to determine the structure of grain production and marketing so that the nature of the storage deficit is disclosed, and to use linear programming to determine the optimum transport movement for grain to storage so that the savings possible from the addition of new storage in the various counties of the state is determined.

North Carolina is a feed deficit state; yet considerable grain (up to 4 million bushels) must be shipped out of the state in order to find storage or be stored in makeshift, undesirable flat storage facilities, such as old cotton and tobacco warehouses. At present, over 2.7 million bushels of the 13.2 million bushels of commercial storage space is made up of flat storage. In order for much of this storage to be used, the grain must be bagged and considerable waste occurs due to insects, rodents, and the breaking open of sacks. If the grain is shipped out of the state for storage, considerable expense is involved later on in replacing this grain with grain grown in other areas.

During the past decade, there have been increases in grain production, amount marketed, and the per cent of grain sold. Changes have also been occurring in the consumption pattern for grain. More concentrates are now being fed in the form of commercially prepared formula feed. There has also been a decrease in the amount of farm produced corn and wheat being consumed in the farm household.

Linear programming was used to determine the optimum transportation program under the assumption that all commercial storage space including both bulk and flat storage space is used and under the assumption that only bulk commercial storage is used. It was found under both assumptions that under present conditions, the least cost transportation program will occur when the grain shipped out of the state is from the northeastern corner of the state. The results also showed that, although there is adequate storage space in North Carolina to take care of the summer harvested grain, if the flat storage is not used during this period, there is considerable increase in the distance grain harvested in the Southern Piedmont counties must travel in order to be stored.

The results of the linear programming analysis were used to locate additional storage facilities within the state. Two different amounts of storage were located according to two different assumptions. On the basis of the results when all commercial storage space was used, 3.5 million bushels of new storage space was located. Since flat storage is undesirable and expensive, 5 million bushels of new storage space was located considering only bulk storage. Under both assumptions, the greatest savings in transportation cost could be realized by locating new storage in the northeastern part of the state.

119 pages. $2.00. Mic 57-1219

THE ROLE OF THE NATIONAL LABOR RELATIONS BOARD AND COURTS IN COLLECTIVE BARGAINING

(Publication No. 20,231)

Mary Lucetta Dooley, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor L. Reed Tripp

Problem and Procedures

Public policy on collective bargaining embraces the appropriate scope of federal governmental supervision. Advocates of free collective bargaining believe that the public interest requires large unrestricted areas of decision-making. Opponents assert that employers, unions and the public benefit from positive governmental intervention.

Resolving controversies over the presence or absence of governmental regulation in collective bargaining is the function of the National Labor Relations Board (NLRB) and courts. Investigating their operation is the aim of this study. Statutory duties of employers and unions to bargain collectively are parts played by the Board and courts in the drama of governmental interference.

More specifically, this thesis includes:

(1) searching the historical setting, institutional and statutory, to gain insights into the role of the Board and courts;

(2) analyzing cases relevant to the Board's mandatory statutory intervention in collective bargaining;

  (a) employer's duty to bargain collectively with the duly authorized representatives of their employees,

  (b) union's correlative duty to bargain collectively with employers under the Taft-Hartley Act,

(3) tracing previous expansion (before 1950) and subsequent contraction (after 1950) of the exercise of

Board jurisdiction; investigating application of these aspects and other Board doctrines;

(4) reviewing enforcement procedures and effectiveness of Board orders as judged by the record on compliance and appeals; suggesting improvements through further diversification; discussing problems enmeshed in federal supremacy and police power;

(5) changing Board personnel in profile--strengths and weaknesses of earlier Boards, philosophy of the current Board, and an estimate of its over-all role;

(6) exploring major policy changes and "twilight zones" in Board and court interpretations;

(7) painting the preceding analysis in miniature;

(8) concluding with the necessary consequences of prior propositions, assuming their validity as premises;

(9) projecting practical collective bargaining relationships into the future role of the NLRB and courts.

Results and Conclusions

(1) Analysis of NLRB and court decisions, as well as related secondary sources, is mandatory in the application of federal labor law provisions to collective bargaining problems.

(2) Perusal of the evolution of collective bargaining concepts contributes valuable insights which are useful tools in solving contemporary conflicts and in guiding future progress along three roads.

(a) One route, proposed by the advocates of free collective bargaining, or the non-interventionists, as they are sometimes called, requires a minimum of governmental supervision.

(b) An alternative street, preferred by the opposition, the interventionists, offers the safeguard of positive governmental interference on an "as needed" basis.

(c) Hybrids, or modifications, of these two basic views are sometimes offered for consideration.

Both sides and the hybrid expounders claim that their ideas would promote the public interest and assure industrial peace and growth, if adopted.

Horizons

Our political leaders, lawyers, and economists, whom we choose to represent us in making these policy decisions at the local, state, federal and international levels, will determine how to build the cantilever bridge between the NLRB and courts in the forward march of collective bargaining today. Their designs will probably become obsolete in the suspended spans of tomorrow.

260 pages. $3.35. Mic 57-1220

PIONEER ECONOMETRICS OF HENRY LUDWELL MOORE

(Publication No. 17,583)

Norman Joseph Kaye, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor E. A. Gaumnitz

This intensive evaluation of the influence of Henry L. Moore is devoted primarily to analyzing the part played by his contributions in developing economic theory through application of methods of statistical verification. It is hoped that by an appraisal of his attempts to employ the econometric method, techniques and methodology currently used will be better understood, and due credit will be given to Moore for the advancement of econometrics. Indirectly, this dissertation hopes to point out that the study of an isolated effort can add as much to the history of a science as an extensive coverage of a whole field.

Although some of the interpretations in this evaluation are necessarily personal opinions of the writer, the great bulk of the analysis is based directly on the writings of Moore from 1895 to 1929. Writings of such men as Marshall in economics, Bowley in mathematics, and Yule in statistics had to be consulted to substantiate Moore's theoretical background. Moore's critics, such as Edgeworth and Wright, and his followers, such as Schultz and Ezekiel, had also to be considered.

The putting together of this source material, with current literature applicable to the subject, was concentrated on three broad categories of Moore's endeavors.

1. Theories of Wages and of Wage Differentials.
2. Economic Cycle Theory and the derivation of the Statistical Demand Curve.
3. Synthetic Economics, the greatest concern of which is the establishment of dynamic, general equilibria for an entire economy.

The end result of this research shows conclusively that Moore has contributed in an important way to a coordination of statistical applications with economic theory through the medium of a general philosophy, all of which is necessary to a science of econometrics. For the most part this statement is verified by showing the clarifications and refinements Moore made in the fields of mathematics, statistics and economics. Specifically, it is in the derivation of demand curves and in the application of his demand curve techniques to forecasting, crop forecasting in particular, more than in the curious appeal of his complex Synthetic Economics, that Moore has established a place for himself and influenced the development of econometrics.

281 pages. $3.65. Mic 57-1221

AN INDUSTRY STUDY APPROACH TO THE PROBLEM OF EXCLUSIVE DEALING

(Publication No. 19,466)

Allen V. Kneese, Ph.D.
Indiana University, 1956

Although exclusive dealing may be a consequence of legitimate and economic business considerations by suppliers and dealers it may also be used as a potent anticompetitive device when imposed by a powerful supplier. Section 3 of the Clayton Act was passed in order to combat the anticompetitive features of the practice. The legislative history of the Act reveals little about the intent of Congress when it wrote the qualifying clause into this section of the Clayton Act. Review of its judicial history reveals however that the courts have used progressively simpler criteria in evaluating the "substantiality" of the competitive impact of exclusive dealing. In many cases the defendants have insisted that an economic investigation of conditions within an industry is necessary in order to gauge the impact of the practice.

This study presents a framework for an economic inquiry concerning the competitive impact of exclusive dealing in particular industries. This framework should prove useful to the antitrust authorities in the selection of cases and serve as a tool useful in gauging the appropriateness of the decision of the courts in particular cases. In addition, it lays the groundwork for studies which are capable of yielding more realistic programs for remedial action than have been applied by the courts in the past.

The elements included in the suggested framework are as follows: (1) a study of the specific nature of exclusive arrangements used in an industry; (2) the scope of the practice; (3) the degree and trend of seller concentration and the related factor of the effective number of actual sources of supply available to dealers; (4) the size and position in the industry of the sellers engaging in the practice; (5) capital investment required for the establishment of new dealer facilities and other factors affecting their value; (6) other factors contributing to the difficulty of entry; (7) the probability that if the practice is ended a vertically integrated situation will replace it.

These factors were applied in the study of three industries - farm machinery, petroleum products, and automobiles. In each case it was found that exclusive dealing as currently carried on is likely to have severely inhibiting effects upon entry. The study however also revealed difficulties in providing effective remedial action in these industries because in none of them is the practice enforced by contracts requiring dealers to represent one supplier exclusively. Rather the practice is maintained by the power which the large supplier can wield over his dealers. When this power is exercised the dealer's franchise is cancelled or not renewed or he is subjected to various sorts of harassment. Most often however, the mere implicit or explicit threat of such power is sufficient to cause the dealer to conform.

Remedial action can therefore only be effective if it reduces the power differential between dealers and their suppliers. In the absence of a policy of dissolution of firms in oligopolistic industries the most practical solution is probably legislation which, in industries where exclusive dealing is a serious problem, gives the dealer a measure of proprietary interest in his franchise and guarantees him a hearing before a court of law in case his supplier does not act in good faith.

372 pages. $4.75. Mic 57-1222

THE PATTERN OF UNION-MANAGEMENT CONFLICT IN THE AUTOMOBILE INDUSTRY, 1937-1950

(Publication No. 20,415)

Lester Samuel Levy, Ph.D.
Cornell University, 1956

This study describes the changing pattern of union-management conflict in the automobile industry from the middle of the 1930's to the beginning of the 1950's. In the analysis of union-management relations, there has been a tendency to emphasize the role of collective bargaining as a means of establishing industrial self-government and as a method by which trade unions usurp the traditional prerogatives of management. Furthermore, students of industrial relations have tended to view trade unions as political-social organizations. The analysis in this investigation, however, in contrast to these tendencies, stresses the business-like character of the trade union and the role of collective bargaining in determining the terms of employment. Thus, this study focuses attention primarily upon economic problems and issues pertaining to industrial relations.

The historical development of the United Automobile Workers and the automobile industry is presented in order to indicate how the union grew to become a large, stable organization and how the industry came to be dominated by a few large firms. With this picture as background, the collective bargaining agreements signed by the union and the companies are analyzed to ascertain the changes that have occurred in the relative importance of various types of contract provisions. The contract policies of the parties to these agreements are derived on the basis of an analytical framework which defines the nature of "policy" and its relationship to "goals" and "tactics". Finally, the contracts and policies are compared in order to indicate the changing character of the conflicts between the union and the companies.

The comparison of the policies of the union, the policies of the companies, and the collective bargaining agreements suggests that there was a rather pronounced shift in the type of issues that primarily were responsible for union-management conflict in the automobile industry between 1937 and 1950. Prior to America's entry into World War II non-monetary issues such as union recognition and security and the union's role in the settlement of the workers' complaints were the major sources of conflict. By 1950, these issues had been superseded by monetary issues such as wage and social security payments.

The fact that large-scale organizations operated on both sides of the bargaining table in large measure may have been responsible for the shift from conflict over non-monetary issues to conflict over monetary issues. Only further investigation, however, can support or refute this view. Additional case studies along the lines of this one would yield a wealth of information from which more definitive hypotheses could be derived and tested. Such information also could provide the basis for a more detailed

analysis of appropriate government policy with respect to big business and big labor than is found in the brief commentary on this subject that concludes this study.

399 pages. $5.10. Mic 57-1223

PRICE CONTROLS IN HAWAII: A REGIONAL INTERINDUSTRY APPROACH

(Publication No. 20,389)

Shelley Muin Mark, Ph.D.
University of Washington, 1956

The regional impact of national defense mobilization is a function both of the scope of the national program and the structure of the regional economy. It has been recognized that the degree of impact upon a region depends largely on whether a full or limited mobilization program is called for. On the other hand, the fact that the accompanying structure of economic controls should be modified to account for unique regional characteristics has been much less obvious. It is the purpose of this dissertation to focus attention on the necessary modifications by analyzing problems of economic control in the Territory of Hawaii, a distinctive regional economy of the United States, during World War II and the Korean War.

A regional interindustry table was constructed to bring out in a logical framework the pertinent features of Hawaiian economic structure. These were: (1) concentration of productive facilities in two plantation crops, sugar and pineapple; (2) heavy reliance on the United States mainland for consumption or input requirements; (3) a persistent import surplus, offset mainly by provision of local services to the Federal government and mainland tourists.

From this characterization of the Hawaiian economy, it was observed that inflationary pressures which accompany defense mobilization are likely to unfold with far greater speed and much less advance notice than in the more diversified national economy. This was attributed to the differing source of inflationary danger in a regional insular situation: namely, the threatened curtailment of final civilian supply, rather than the diversion of resources from civilian to military output. Further, because of regional economic structure, it is highly possible that sharp increases in the price level may occur, despite the existence of considerable unemployment. All of this suggested that unqualified application of national controls to such a regional environment would not result in the desired measure of economic stabilization. This was clearly brought out in analysis of Hawaiian experience under full mobilization conditions of World War II and partial mobilization of the Korean period.

During both periods, there was hesitancy in the use of price controls as an anti-inflationary device at the national level and even greater delay in their effective application to the islands. Consequently, a more violent inflation occurred in Hawaii than on the mainland during World War II. However, the situation was alleviated by the effectiveness of price controls when finally applied and the gradual improvement in the food supply outlook. During the Korean period, Territorial prices increased to roughly the same extent as on the mainland. However, the mainland increase took place from a fully-employed economic base, while the comparable insular increase occurred despite a record unemployment level. The causal factor in both cases was excessive anticipatory buying, based on recollection of shortages during World War II and supported by the high degree of liquidity attained since that period.

While indirect controls have won support as effective anti-inflationary measures on a national basis, their effectiveness in a regional situation was shown to be much less certain. Consequently, the conclusion was reached that under conditions of both full and partial mobilization, price controls are likely to be the first and perhaps only line of defense against the special type of inflationary threat which is characteristic of narrowly-specialized insular economies. Appropriate stabilization policy, therefore, calls for early imposition of such controls in the event of future emergency.

245 pages. $3.20. Mic 57-1224

AN ECONOMIC ANALYSIS OF FEED UTILIZATION FOR MILK PRODUCTION IN NORTH CAROLINA

(Publication No. 20,183)

Wilmoth Charles McArthur, Ph.D.
North Carolina State College, 1956

Supervisor: Charles E. Bishop

The major problems of feed utilization for milk production relate to (1) the selection of least-cost combinations of feed for given levels of milk output and (2) the determination of most profitable rates of feeding under specified price situations. The choice of minimum-cost rations depends on the marginal rate of substitution between feeds and the price of one feed relative to another. The most profitable rate of feeding depends on the rate of transformation of feed into milk and the feed-milk price ratio.

The primary objective of this study was to provide a basis for determining the profitability of different systems of feeding in the production of milk. More specifically, the analysis included the estimation of (1) basic production relationships, (2) least-cost combinations of feeds and (3) maximum profit rates of feeding.

Data from a feeding experiment conducted at the University of Connecticut were used to approximate forage-grain substitution relationships over a narrow range of net energy intake. Another set of data obtained from an experiment conducted at North Carolina State College provided information on the range in which substitution might occur and also on the profitability of different rates of grain intake and free-choice hay.

In analyzing the Connecticut data, two systems were used to characterize the rations with respect to productive value. These measures were (1) net energy and crude fiber and (2) pounds of hay and grain. Covariance techniques were used to derive the "between cow" and "within cow" variance values. This procedure provided two sets of values which were used in describing the regression relationship between feed intake and milk output.

From each set of data, regression equations were derived to describe the relationship between different quantities of feed intake and milk output. Milk output per 100

pounds of live weight was expressed as a function of the therms of net productive energy per 100 pounds of live weight and the per cent of the ration composed of crude fiber. In addition, hay and grain were used to characterize the ration. Equations were then derived to obtain (1) the different combinations of forage and grain required to produce a given quantity of milk and (2) marginal rates of substitution between forage and grain.

A quadratic type function was fitted to the energy and fiber data in order to test the nature of forage-grain substitution relationships. The fiber coefficients of this function provide a test of these relations. These coefficients (linear and curvilinear terms) were significant by the t-test, indicating decreasing marginal rates of substitution between feeds. A Cobb-Douglas type function which forces decreasing rates of substitution was fitted to the Connecticut data where pounds of hay and grain were used to characterize the ration. In both cases, similar results were obtained, indicating that forage and grain substitute at a decreasing rate.

Variations in the nutritive value of different feeds indicate a need for some basic measure of the productive value of rations. Net (or productive) energy is generally considered the most fundamental of the different measures available. Thus, feed-milk relationships based on net energy and fiber have general application to other rations while production relationships based on hay and grain relate only to that particular hay and grain.

The costs of different feed combinations were computed for three price situations representing the mean and extreme corn-hay price ratios of the period, 1939-54. The cost of producing a given quantity of milk per day is at a minimum when the hay-grain price ratio is inversely equal to the hay-grain substitution ratio. Comparisons were made of optimum (least-cost) rations as derived with different functions from rations characterized by (1) energy and fiber and (2) hay and grain. With hay and corn priced at 1.8 and 3.8 cents per pound, respectively, the cost of the optimum feed combination derived with a quadratic function from energy and fiber amounted to 42.7 cents to produce 23 pounds of milk daily per cow compared with 44.8 cents for the optimum ration derived with a quadratic function from hay and grain. Under the same price situation, the cost of the optimum ration derived with the Cobb-Douglas function from hay and grain amounted to 41.0 cents to produce 23 pounds of milk per cow. In general, variations in the costs of optimum rations based on different functions and on different measures of ration value were relatively small for a given price situation.

In adjusting feeding practices to changes in price relationships, farmers must have information on the production response of cows to different rates of feed intake and on the possibilities of substituting one feed for another in the dairy ration. This study suggests a basis for determining these basic production and substitution relationships which are essential to farmers for making decisions in feeding livestock. 110 pages. $2.00. Mic 57-1225

AN INQUIRY INTO THE NATURE AND SIGNIFICANCE OF THE STRIKE

(Publication No. 20,637)

Duncan Witten Murphy, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Edwin E. Witte

A proper evaluation of the strike problem and the development of sound public policy in this area must be based upon an understanding of the nature and significance of the strike as an expression of industrial conflict. This paper represents an inquiry into the nature and significance of the strike in the light of historical developments and recent trends. It is based upon the large volume of research and writing in the field of industrial relations. Use has been made of books of both a scholarly and popular nature, scholarly journals, general periodicals, newspapers, labor publications, publications of employer groups, government publications and documents, and, though this is not intended as a legal study, of court decisions and statute law where appropriate.

In Chapter I the strike is defined and discussed in terms of its essential elements. Preliminary consideration is given to the nature and significance of the strike and an analysis made of strikes versus lockouts and of the various kinds of strikes. An examination is made in Chapter II of the strike problem, both from the point of view of the "general public" and in the light of available statistical evidence. Chapter III is concerned with the strike as a form of industrial conflict. It examines the nature of industrial conflict under capitalism and presents early developments in the use of the strike and the attitudes of organized labor toward the strike prior to 1900. The significance of the strike depends to a large extent upon the nature of the organization using it, and various groups in this country have competed for the leadership of the labor movement. Chapter IV deals with the place of the strike in these various labor ideologies. Today "business" or "job conscious" unions are almost the only ones making use of the strike weapon and Chapter V shows what the strike has become in the hands of trade unions devoted to the practice of collective bargaining. A brief examination is made in Chapter VI of the attitude of employers toward the strike and collective bargaining. Chapter VII presents a review of the ideas of students of industrial relations concerning the nature and significance of the strike with particular reference to: (a) the strike as a protest, (b) the strike as a means of regulating the market, (c) industrial conflict, (d) the economic effects of strikes, and (e) the propensity to strike. In Chapter VIII certain conclusions are drawn by the writer.

In a free democratic society industrial conflict can not be entirely eliminated. Consequently, a realistic choice must be made concerning the way in which it will be expressed. Collective bargaining, with its possibility of strikes, is one of various alternatives. Collective bargaining, however, is a means of resolving conflict, not eliminating it, and a certain amount of overt conflict must be expected. It is, in a sense, a cost of collective bargaining. However, in the light of various alternatives, this cost does not appear to be excessive. Under collective bargaining strikes are the exception. When they do occur, certain costs are involved. These costs, however, are

frequently exaggerated and against them must be reckoned the gains, for the strike performs certain useful social functions. In recent years much has been done to adapt the use of the strike to the requirements of the free enterprise system, and much of the bitterness and violence which accompanied strikes in the past has disappeared.
306 pages. $3.95. Mic 57-1226

A STUDY OF THE LABOR MOVEMENT AND INDUSTRIAL RELATIONS IN THE COTTON TEXTILE INDUSTRY IN BOMBAY, INDIA

(Publication No. 20,648)

Gus Tolver Ridgel, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Selig Perlman

After securing her independence from Great Britain, India was faced with the tremendous task of trying to embark upon a program of rapid industrialization, impeded by the "Partition" and a large, primarily agrarian, population. The architects of India's economic and industrial development conceive of a program of rapid industrialization, under a democratic form of government, through a series of Five-Year Plans.

This developmental period of the Indian economy provides an excellent opportunity for the study of a labor movement in its formative stage. Although a few of the existing unions were founded in the 1920s, the labor movement is actually passing through its embryonic phase. It is the purpose of this thesis to examine the labor movement and industrial relations in the cotton textile industry in India in an attempt to determine its status quo, as well as its probable trend. Geographically, the study is confined to Greater Bombay (Bombay City and Island) and Ahmedabad.

Historically, the labor movement in India has been led by persons drawn from the ranks of the intellectuals; leadership from the rank-and-file has been a rarity. The labor force was usually drawn from nearby villages and surrounding rural areas. The political alignment of the labor unions frequently caused trade union policy to be subordinated for political expediency.

These conditions are yet extant in the contemporary labor movement. The role of the intellectual cannot be over-emphasized; this coterie actually occupies the position of labor union leaders and control the destinies of a large majority of the organized labor. Each of the four major federations owe allegiance to one of the major political parties. Although an increasing number of trade unionists and students of the labor movement are beginning to feel that such a relationship is to the detriment of labor unions, there is no evidence of a divorce being effected.

Bombay and Ahmedabad represent one of the first post World-War II unions and one of the oldest continuous labor unions in India. The officially "recognized" union in Bombay is yet fighting the battle to: acquire workers' loyalty; develop internal sanctions; and establish itself as the true spokesman for the Bombay textile workers. In Ahmedabad, the Textile Labour Association was founded under the guiding hand of Mahatma Gandhi, and continues to adhere to Gandhian principles. Since its inception in the 1920s, it has firmly established itself as the spokesman for the textile workers in Ahmedabad.

Both unions are characterized by a high degree of centralization in union structure. There are no units of organization possessing the characteristics of local unions that might serve as schools for training leaders from the rank-and-file. There is too great a distance between the leaders and those who are led. This is probably true, to a greater extent, in Bombay than in Ahmedabad.

Capitalism is not accepted as the desired economic system by either the Government or the labor unions. The Central Government has told private enterprise that it must either accept the proposed program of "worker-participation in management," or the Government would be compelled to impose controls or even to take over the industry. Both unions have constitutional provisions calling for the nationalization of the textile industry.

The labor movement in India is yet searching for a philosophy that will serve as a "rallying point" for the splintered unions. No serious attempt is being made to discover and develop a philosophy native to labor. The intellectuals expound a philosophy that they "believe" is best for the illiterate members and then try to sell this philosophy to the rank-and-file. The primary difficulty has been that many of the workers have refused to buy their wares.

India is faced with the decision of whether she wishes to develop a strong, free trade union movement, or whether she wishes to develop a trade union movement completely subservient to the political sphere, exercising a purely disciplinary function. 400 pages. $5.10. Mic 57-1227

COST FUNCTIONS AND SUPPLY-PRICE FUNCTIONS: THEIR DERIVATION FROM SURVEY DATA

(Publication No. 20,184)

Sheila Isabelle Rowley, Ph.D.
North Carolina State College, 1956

Supervisor: C. Addison Hickman

The first object of this thesis was to distinguish between the short-run cost function and the long-run supply function of an industry; the distinction between them was based on the length of the time period to which each referred. The second object was to illustrate the usefulness of regression methods in cost analysis. Some of the economic literature on cost analysis was reviewed, particularly papers reporting the numerical results of cost surveys.

Explicit functional forms were proposed for the total average and marginal cost functions of an industry, all these functions relating to the short period. It was postulated that they could all be represented by straight lines in logarithmic space. The underlying short-run relationship in the cost-output system was postulated to be the bivariate-normal distribution, where the variates were the logarithms of total costs per firm and the logarithms of output per firm in any single time period.

The use of the bivariate-normal model and the corresponding conditional form of the same distribution was

illustrated by calculating estimates of the parameters of that model from 13 sets of numerical data. The data was collected by means of sample surveys in the milk industry of England and Wales, and in the wheat, wool and butterfat industries of Western Australia. It was pointed out that the regression coefficient of the bivariate-normal model in the logarithms of the variates had the property of invariance, which is a particularly useful property in analysis of economic data.

Brief consideration was given to long-run relationships between average costs and output. The economic literature on the subject was reviewed, with particular attention to the writings of Alfred Marshall. Some suggestions were made concerning the type of numerical data that might be suitable as a basis for compiling the supply function of an industry empirically. Many difficulties which are inevitably involved in the analysis of time series of economic data were mentioned. The main object of discussing the long-run relationships was to distinguish them from the simpler short-run relationships. 153 pages. $2.05. Mic 57-1228

ECONOMICS, COMMERCE - BUSINESS

CHARACTERISTICS OF THE RETAIL FEED BUSINESS IN WISCONSIN – 1954

(Publication No. 19,071)

Cyril Adeniyi Bright, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor Henry H. Bakken

The retail feed business in Wisconsin had its beginning around the end of the last century. Since commercial feeds at that time, to a large extent, consisted of the by-products of the flour milling industry, it was only logical for the trade in these feeds to follow the same channels of trade as grain which provided the raw materials for the industry. The development of the mixed feeds industry created a break in these channels by absorbing a large portion of the by-products of the milling industry. Thus a new channel was developed, which also, was not very secure; for it was not long before specialized retail feed stores, with franchises from feed manufacturers and processors to handle their products, emerged. Inasmuch as most of the feeds sold by the mixed feeds industry had to be compounded with home grown feeds, in order to enhance trade, it was necessary for local feed merchants to have facilities for processing the home-grown feedstuffs of their farm customers. The specialized feed stores were equipped with such machinery and were therefore of greater service to farmers in their feeding operations. On this account, these stores have remained, through the years, practically the exclusive handlers of commercial feeds.

In 1954, there were approximately 1,600 retail feed stores in the state and most of them were owned by merchants who also handled other lines of business. The retail feed business is strictly an entrepreneural, single-unit type of business inasmuch as 83 percent of the dealers were found to own not more than one point. In general, the number of stores per area was greater in the southern portion of the state because of the relatively heavy livestock production in the area. With regard to the age of firms, a few were reported to have been organized as early as the 1870's and in all, 14 percent came into existence before 1917. Thirty-eight percent of the stores in operation today were organized since 1940.

The average retail feed store in 1954 had 350 regular feed customers distributed over an area of nine miles in radius from the location of the store. In this area, there are usually four other competing retail feed stores. Since feed stores are more concentrated in the southern part of the state than in the north, the area served by the average feed store in the south was smaller; and they reported a greater number of customers and more competitors than those in the north. It was revealed that the average feed store had gross sales, arising from the numerous categories of merchandise handled, amounting to $250,000 in 1954. Feed sales usually amount to 46 percent of total sales and the average feed customer purchased about $328 of feeds and feed ingredients during the year.

A large number of firms were equipped with feed processing machines such as mills, mixers, corn crackers, corn shellers, molasses mixers, and oat hullers in order to render the necessary services for their customers. Many of the firms claimed that these services are usually rendered at prices below the actual costs of operation since they are offered as inducements to farmers in order to meet competition.

Thirty-nine percent of gross sales was made on the basis of granting credit to customers. As a policy, the average feed store allows credit for 48 days without interest and an interest charge of six percent is in effect on all credit amounts outstanding beyond the interest free period.

This study is essentially an inquiry into the economic conditions of the retail feed business in Wisconsin. In a real sense, it is exploratory in nature serving as a guide to researchers who may later wish to perform a more analytical job on various facets of the industry. It highlights a few of the major problems of the business and calls attention specifically to: the credit situation; extent of competition; the costs-return relationship of machinery and equipment; and the transactional relationship between suppliers and customers. It is hoped that when subsequent studies are made, specific emphasis will be given to these and other problems. 147 pages. $2.00. Mic 57-1229

ECONOMIC LIBERALISM IN ITALIAN FOREIGN TRADE, 1946-1953

(Publication No. 20,629)

Karel Holbik, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor P. T. Ellsworth

The Italian economy represents and was selected as a suitable case for the study of the difficulties which the liberal economic policies pursued by the recipients of the Marshall Aid, have been up against. The difficulties of Italy result from the structural weaknesses of her economic

system, the extensive involvement of the Government in the nation's economic life, and the economic heritage of Fascism.

After ascribing the liberal point of view expressed in Italian economic policies to the influence of the economists of the "Einaudi Line," this thesis examines the principal actions which the Government took during the eight-year period 1946-1953 -- divided by the writer into four biennia -- in the realm of foreign trade. It relates these policies functionally both to the exigencies of the country's internal economic situation, and to the chief post-war international institutions under whose impact Italy has found herself, i.e., the General Agreement on Tariffs and Trade, the Organisation for European Economic Cooperation, and the European Coal and Steel Community.

During the first biennium, 1946-1947, efforts of the Italian Government were concentrated on the Lira exchange rate. They represented an endeavor not only to bring about a realistic relationship between the Italian and other currencies, but also to facilitate the country's re-integration into world economy. In this connection, the Government introduced first a multiple, and afterwards a flexible exchange rate system.

During 1948-1949, Italy's international economic policies were predicated on the developing internal stagnation on the one hand, and on the impact of the O.E.E.C. trade liberalization and payments schemes on the other. The beneficial effects of the O.E.E.C. projects were partly offset by the reprecussions of the Anglo-Italian Agreement --which corrected the undervaluation of the Pound--and by the relatively minor depreciation of the Lira in September 1949.

In 1950-1951, the Government liberalized Italian private imports from the O.E.E.C. area by 99.7 percent, an unusually high degree for Italy. As a result, all import liberalizations and the tariff concessions granted by Italy during the G.A.T.T. conferences at Annecy and Torquay encountered vigorous opposition among Italian manufacturers. However, the Government was too deeply convinced of the advantages of intra-European cooperation to be dissuaded from its liberal objectives.

The international position of Italy deteriorated when, after the Korean war had ended, some important purchasers of Italian manufactures re-introduced their import restrictions. During this fourth biennium, 1952-1953, the unfavorable conditions in which some Italian industries found themselves, gave rise to a controversy concerning the pros-and-cons of the existing liberalizing policies. The Government defended its program by pointing out that liberalized imports, especially, benefited contemporary expansion of domestic production and investment.

The observations made in our study justified the conclusion that Italy gained a great deal through her participation in Western European cooperative projects. The thesis shows, however, that the scope of post-war Italian liberalism in foreign trade did not conform to the orthodox model because of the very nature of the country's economic organization, which made adherence to the principles of such a model inconceivable. Nevertheless, the Government adopted in its balance of payments adjustment policies two liberal-economic measures, disinflation and devaluation. But these measures became effective only through extensive official controls. To avoid foreign trade restrictions, Government officials chose to rely basically on two methods for the balancing of Italian international accounts: 1) internal economic expansion, and 2) progress of Western European economic integration.

290 pages. $3.75. Mic 57-1230

MARKETING POLICY DETERMINATION BY A MAJOR FIRM IN A CAPITAL GOODS INDUSTRY; A CASE STUDY OF BUCYRUS-ERIE COMPANY, 1880-1954

(Publication No. 19,025)

Kenneth Holston Myers, II, Ph.D.
Northwestern University, 1956

Adviser: Edward M. Barnet

A study of the marketing policies of an outstanding manufacturer of excavating machinery, especially power shovels and draglines. The central theme is provided by four interrelated propositions: (1) the marketing policies of a builder of heavy machinery will adjust over time in response to changes in the industry and firm demand schedule, (2) these changes will be in the same direction as, and greater than, shifts in the general level of business activity, (3) significant improvements in the design of existing machines, or the introduction of entirely new machines for a given task, will also affect the demand for, and elicit adjustments in, a firm's marketing policies, and (4) recurring patterns of adjustment in marketing policy will occur in response to (a) fluctuations in the general level of business activity, and to (b) the technological obsolescence of its products. Principal emphasis is on the fourth proposition, i.e., recurring patterns of adjustment.

The study uses the historical method: an analysis of past marketing policies, the changes therein, and the effects thereof, all in the context of particular time periods. The author had full access to Company records, correspondence, and personnel over a period of three years as a result of doing the research for this study concurrently with the research and writing on a Company history: H. F. Williamson and K. H. Myers, II, Designed for Digging (Evanston: Northwestern University Press, 1955).

The introductory chapter describes the problem, scope, contribution, sources, relevant literature, and method. Next is a chapter describing the Company, its products, the industries of which it is a part, and the markets which it serves as of the mid-1950's. The third chapter concerns the Bucyrus Company and its predecessors (1880-1927) and outlines the companies involved, their products, the industries of which they were a part, the markets which they served, and the adjustments made in marketing policy in response to economic disturbances and the technological obsolescence of their products. The next two chapters do the same for the Erie Steam Shovel Company and its predecessors (1883-1927) and the Bucyrus-Erie Company (1928-1954). The sixth chapter discusses certain critical aspects of marketing policies for the various managements involved: concept of markets, concept of product line, concept of marketing strategy. The seventh and final chapter summarizes the findings in respect to recurrent patterns of response. Certain changes in organization and marketing policy are also suggested as

being likely to result in a more favorable adjustment to future economic disturbance and technological obsolescence than has been exhibited in the past.

The findings of the study were (a) certain recurrent responses to economic disturbance have occurred, mainly in respect to variable prices, trade-ins, credit, delivery, variety of standard products, and addition of new product categories, (b) a pattern of "watchful waiting" and reliance upon fortuitous purchases of new product developments has characterized the Company's response to technological obsolescence. As a result of the latter pattern, the Company's growth has not kept pace with the machinery requirements of its major customer groups. The probable causes of this pattern were indicated, and corrective measures were suggested. 526 pages. $6.70. Mic 57-1231

ECONOMICS, FINANCE

THE AVOIDANCE OF FEDERAL PERSONAL INCOME TAXES IN THE UNITED STATES

(Publication No. 18,055)

Jack Emanuel Gelfand, Ph.D.
New York University, 1956

Adviser: Dr. Richard A. Girard

The purpose of the thesis is (1) to survey the most prevalent practices in avoidance of the federal personal income tax in the United States, (2) to survey the factors that initiate and perpetuate these practices, and (3) to suggest directions in which to seek remedies for the correction of these practices. The study briefly examines the objectives and the structure of the personal income tax. The objectives are taken to be equity, minimum reduction in economic efficiency, income redistribution, economic growth and stability. The structure is divided into four parts: definition of income, determination of the base, method of assessment, and structure of rates. Avoidance is defined as the selection from several choices of a lawful arrangement of transactions that provides tax advantages to the taxpayer which are not equally available to the general taxpaying public.

Avoidance methods are classified into three broad categories. Sheltered income escapes taxation completely since it is either excluded from income subject to tax or is deducted from gross income to arrive at taxable income. Warped income is income that is perverted to resemble preferentially taxed capital gains. Fractioned income takes advantage of the progressive character of the tax by either splitting income among related taxpaying entities or deferring a portion of the income to another period when income and consequently the marginal tax rate are expected to be lower.

The legal basis and tax benefits of specific avoidance devices are treated in five chapters under the headings of Excluded Income, Deducted Income, Capital Gains, Split Income, and Deferred Income. Excluded income encompasses interest on municipal bonds, and non-monetary remuneration such as executives' perquisites and employees' fringe benefits. Deducted income is divided into business deductions and personal deductions. Under business deductions, avoidance may be practiced by perverting personal expenses into business deductions, by taking advantage of the special depletion allowances and other privileges granted to extractive industries, or by the judicious taking of capital and business losses. Charitable contributions, medical expenses, and interest and tax deductions for owner-occupied dwellings are the personal deductions that lend themselves to avoidance. A number of methods of warping ordinary income into capital gains are presented. These include undistributed corporate profits, accelerated depreciation, stock dividends and stock splits, tax-exempt dividends, bonds bought at discount, oil royalties perverted into capital gains, restricted stock options, plowed-back agricultural earnings, and plowed-back real estate earnings. Gifts, family partnerships, trusts and gift and lease-backs are the methods listed for splitting income among taxpayers. Income may be deferred through the use of qualified retirement plans, long-term contracts, employees' trust funds, insurance plans, restricted stock options, and equalization of commissions.

The study examines ten previous loopholes closed by law and concludes that a piecemeal solution to the problem is ineffective.

The findings of the study are that initiating, implementing, and perpetuating factors of tax avoidance lie in the conflict of objectives and structure of the tax itself, and in politically dictated high tax rates that are offset by escape hatches. High and steeply progressive tax rates provide the motive to seek tax relief through avoidance, while the conflict in defining income subject to tax, the progressive structure of tax rates and congressional errors of omission and commission provide the avenues through which avoidance is practiced.

The study recognizes the practical impossibility of providing an avoidance-free progressive income tax at substantial rates, but reasons that avoidance can be substantially reduced. It recommends that Congress seriously consider broadening the concept of income subject to tax, redefining the base of the tax in the light of the answers to questions raised in the study, reducing the level and progressivity of the tax rates, and limiting its use of the income tax for incentive purposes.

213 pages. $2.80. Mic 57-1232

THE SHIFTING AND INCIDENCE OF EXPORT TAXES IN UNDERDEVELOPED COUNTRIES

(Publication No. 20,602)

Frank Harry Jackson, Ph.D.
University of Arkansas, 1957

Major Professor: H. P. Jenkins

This dissertation introduces a method for determining the incidence and burden of export taxes in underdeveloped countries and demonstrates the influence on incidence and burden of variations in certain elements of the economic structures of these countries.

Incidence is defined as the location, and burden as the

measure, of changes in real incomes resulting directly or indirectly from the introduction of a tax. Such real income changes are, in turn, identified by changes in money incomes and in purchasing power possibilities. These latter changes are determined by using comparative statics with a general equilibrium model that includes selected features common to many underdeveloped countries.

The significance of variations in selected economic elements of the model as influences on incidence and burden is illustrated by assuming a constant tax rate, holding all but one of the elements of the model constant, and allowing the characteristics of the remaining element to vary. The elements considered are the degree of factor scarcity, the degree of factor specialization, "industry" input-output relationships, group consumption patterns, and the allocation of government tax receipts.

The use of comparative statics as a part of the method is particularly appropriate because many of the important price determining elements in underdeveloped countries are themselves static and strongly resistant to change. General equilibrium analysis is used because of these same considerations plus the fact that the number of variables which must be handled is relatively small.

198 pages. $2.60. Mic 57-1233

THE CAPITAL STRUCTURE OF CONSUMER FINANCE COMPANIES: BASED ON A SURVEY OF MICHIGAN LICENSEES

(Publication No. 19,012)

James Rubert Longstreet, Ph.D.
Northwestern University, 1956

This study analyzes the methods by which Michigan consumer finance companies financed their operations during the period 1948-52. Capital structures of national companies, state chains and single-office firms are presented by classes and in aggregates for the industry. The data provide a cross-section of consumer finance companies of all sizes and facilitate comparisons of companies by classes. The distribution of capital structures is analyzed to ascertain, as far as possible, the major factors influencing the financial decisions of consumer finance companies and to indicate some of the regulatory problems implicit in the application of uniform regulations upon a heterogeneous group.

Consumer finance companies practice extensive trading upon equity. One of their major characteristics is the large quantity of credit obtained from commercial banks on short-term notes. The availability of borrowed funds for small and intermediate size companies has increased substantially in recent years. While the improved borrowing abilities of the smaller companies has reduced the differences in trading upon equity among consumer finance companies, there are still substantial variations among classes of companies. National companies use long-term debt more extensively than either state chains or single-office firms. Both state and national chains use borrowed capital more extensively than single-office firms.

Interest cost and availability of funds favor state and national chains. Of these two factors availability of funds has probably been the more important variable in the period 1948-52. However, any significant decline in the spread between the rates of return on assets and interest rates on borrowed funds might well reverse the relative importance of cost and availability in the future.

The process of establishing maximum small loan rates requires an estimate of the minimum rate of return to equity capital necessary to attract private capital into the field. The process of evaluating the actual profitability of small loan operations should be based on a representative capital structure for consumer finance companies. The distribution of capital structure proportions among Michigan companies suggests that the selection of such a representative capital structure involves social decisions regarding the desired nature of the industry providing the small loan service.

The cost of capital tends to vary with the capital structure of a company. The investigation of Michigan consumer finance companies indicated that their cost of capital varies substantially between classes of companies. The cost of their borrowed funds tends to vary inversely with the size of the company, and their degree of trading upon equity tends to vary directly with size. The implied cost of capital for national chains, which provided over 70% of the small loan service, would therefore be substantially lower than the implied cost of capital of the single-office firms which represent the bulk of the corporate population.

Effective regulation of consumer finance companies requires extensive knowledge of the intra-industry variations in capital structure proportions. Existing data in most states are based on inadequate aggregate balance sheets and seldom provide a realistic cross-section of corporate financial practices. The data presented in this study provide the first detailed information of this type and indicate the need for more extensive study by regulatory commissions.

482 pages. $6.15. Mic 57-1234

ECONOMICS, HISTORY

THE PROCESS OF ECONOMIC DEVELOPMENT IN SYRIA, THE GROWING ROLE OF THE GOVERNMENT

(Publication No. 20,254)

Hassan Ahmed Muraywid, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Edwin E. Witte

This enquiry is a pioneering study of the process of economic growth and expansion in Syria. A complete analysis relating the more significant factors in the growth and development of the Syrian economy is attempted. This study is based mainly on source materials and documents in Arabic, published by the different Ministries of the Syrian Government; the various branches of the League of Arab States; private research and educational institutions; and by the specialized agencies of the United Nations, sponsoring different inter-Arab and regional conferences. Background material and documents in the French language were helpful for setting the stage during the past twenty-five years. They were mainly published by the Haut

Commissariat and the Banque de Syrie. Finally, the International Bank of Reconstruction and Development and the International Monetary Fund have made many studies on different aspects of the Syrian economy, with the most inclusive of these published by the former, under the series title of The Economic Development "of Syria."

Chapter one of this thesis on the human and non-human resources of the country focuses attention on the straregic importance which population growth assumes in economic development, compared with the rate of growth in productivity. All available data is analyzed relevant to birth and death rates, the degree of efficiency in its different phases of education, health and the acquisition of skills. Non-human resources dealt with, include the different economic regions of the country and their relative supplies of capital equipment, water resources, soil fertility, minerals, forests, livestock and fisheries. A note on health and education traces the progress achieved in both fields during the last three decades. Chapter two concerns itself mainly with the role of capital accumulation in the process of economic growth. A detailed study of the supply of capital explores the domestic sources of capital, the phenomenon of hoarding, the impact of unemployed and underemployed resources, and the institutional defects of Syria's economy. Here attention is directed to the causes of conservatism and limited trust in financial institutions; the fact of low aggregate savings; and the undeveloped banking institutions of the country. A following note on technology and entrepreneurship emphasizes the increasing importance of the entrepreneur in sponsoring change and progress.

In Chapter three the importance of agriculture is stressed. Special attention is given to the impact of agricultural credit on rural development and to the different credit institutions; also to agricultural cooperatives and the marketing of the seasonal produce, and to the land tenure and its social, political and economic consequences. The growth and expansion of Syria's industry is discussed in Chapter four. The dominance of private enterprise and individual initiative establish the background setting. The majority of the country's manufacturing industries are old and well established. But important new industries have developed recently. The role of the government in this development has been diversified; protection of infant industries under specific conditions, credit facilities, and fiscal exemptions. Beginning in 1945 successive laws have regulated the expansion of industry; with special emphasis on encouraging exports.

Syria's position in the world economy is evaluated in Chapter five. This includes a statement and evaluation of Syria's export and import policies and a discussion of the foreign exchange problems. Foreign trade composition, and the policies of trading partners and the balance of payments position and terms of trade are also considered. The very important question of financing economic development is discussed in Chapter six. Here the different sources of domestic revenues, ordinary and extra-budgetary, are analyzed and their respective role in financing development projects is considered.

Past experience demonstrates the increasing role of the money market and the commercial banks in financing development projects. The author believes that this study suggests strongly the desirability of planning for growth and economic progress within a regional framework. Syria needs not only substantial inflow of regional capital, investments for its development, but will also benefit from a larger regional market, with a steadily increasing purchasing power. It is fortunate that the present tendency among the Arab countries is toward greater regional integration. 251 pages. $3.25. Mic 57-1235

AN ECONOMIC HISTORY OF THE BAKING INDUSTRY TO 1930

(Publication No. 19,026)

William George Panschar, Ph.D.
Northwestern University, 1956

The study of the history of the baking industry traces and analyzes the economic growth of baking from its early handicraft operation in colonial times to its status in 1930 as one of America's foremost industrial activities.

The purpose of the study is twofold. The first is to show how, why, and when the market structure and competitive pattern in the industry evolved. In this sense, history becomes a laboratory for observing market structure and behavior in the past and for showing how historic changes in the organization of the industry have influenced the shape of its modern organization. This is shown to be an evolutionary process rather than a revolutionary one in that changes in the structure of the industry are part of a continuous and cumulative action. The second purpose of this study is to get at the very heart of the process of economic change in the development of a modern industry. By describing the changes in the baking industry and by analyzing their causes and the reactions to them, the historical treatment centers attention upon the economic forces that make for change in an industrial economy. These forces are seen to be not only those of a physical and technical sort, but also those which include the social and economic environment.

The history of the American baking industry is divided into three broad time periods: from early colonial times to 1850, 1850-1900, and 1900-1930.

The years before 1850 serve as an introduction to the growth of the modern industry. Building upon the Old World heritage dating back to the discovery of baking some 10,000 years ago, this period traces the establishment of an organized baking trade from the days of the early American settlements to the beginning of the nation's industrialization about 1850. It was an era during which the art of baking experienced relatively little change, being carried on in 1850 in much the same manner as in the time of the Roman Empire.

The second period, 1850-1900, immediately preceded that of the industrial expansion of baking. It is viewed as an incubation period for the industry, one in which the necessary technical, social, and economic conditions for industrial emergence were fashioned. It was during this period that baking first began the transfer from the home to the bakery, resulting in the initial emergence of large-scale production and distribution and fashioning the oligopolistic pattern of competition.

The time span between 1900 and 1930 was the period of industrialization for the baking industry. During these years baking clearly emerged from its craft setting as the industrial bakers--those distributing beyond the confines of their bakeries--rose to dominance in the industry. Due

to the effects of urbanization and increasing real income which followed from America's rapid industrialization, the consumption of commercially baked goods eclipsed for the first time the consumption of home baked products. The increased demand sparked by the decline in home baking provided the stimulus for the industrial development of baking. By 1930, both in terms of industry structure and its resultant market behavior, baking had substantially developed its present form and organization.

The industry was to continue its expansion over the next two and one-half decades primarily due to a continued decline in home baking. It was to undergo the rigors of a major depression and the boom of the war that followed, but its basic structure was to remain essentially unchanged from its 1930 counterpart.

304 pages. $3.90. Mic 57-1236

ECONOMICS, THEORY

WELFARE ECONOMICS AND THE THEORY OF OPTIMUM PUBLIC UTILITY PRICING AND THEIR PRACTICAL APPLICATION WITH SPECIAL REFERENCE TO FEDERAL TRANSPORTATION POLICY (PARTS ONE-THREE)

(Publication No. 18,809)

Thomas Anton Martinsek, Ph.D.
The Ohio State University, 1956

One of the considerations in the setting of public utility rates is the achievement of an economic optimum. The theory of welfare economics is basic to the definition of such an economic optimum. The economic optimum having been defined, considerations of practicality of application arise.

The method used in the study was to deduce from propositions of contemporary welfare theory the nature of the industry to be controlled and the patterns of optimal control as applied to long-run price setting, short-run price setting, standards applicable to new investment, and contracting and dying industries. The standards derived were then considered as to practical application. The consideration of practicality was based on the examination of federal transportation policy, for purposes of comparison, and on the analysis of the pricing standards from the standpoint of the requirements for practical application.

A public utility, from the standpoint of economic welfare, was defined as an industry characterized by two conditions: 1) decreasing marginal costs to scale for the firms in the industry; and 2) gains from regulation accruing to consumers sufficient to pay for the costs of regulation when such gains were taxed away. The basic standard for long- and short-run pricing is marginal cost. Deficits from the marginal-cost pricing should be financed by lump-sum taxes. If the gains to individuals from marginal-cost pricing are sufficient to cover the deficit, marginal-cost pricing is possible. The desirability of new investment, by welfare standards, is determined by comparison of the increased consumers' surplus from the new investment and the cost of the new equipment plus the undepreciated remainder of the old plant. If the increased consumer surplus is sufficient, new investment is desirable from the viewpoint of economic welfare.

The conclusions from the practical consideration were to the effect that marginal-cost pricing to achieve the optimum is not feasible. Instead, average-cost pricing, with certain allowable deviations, administered by a well-informed commission with an intimate understanding of the controlled industries was recommended. This recommendation was based on several grounds. Because of imperfections in the economy, the optimum price is greater than marginal cost. Average-cost pricing, therefore, is as likely to contribute to the optimum as is marginal-cost pricing. Average-cost pricing is more amenable to ex post verification. Judging by the evidence of pertinent court cases, average cost accords with general feelings of justice. Average cost is more readily understood than is marginal cost. The overwhelming problem of levying lump-sum taxes equal to or less than the individual gains from marginal-cost pricing is avoided by the use of average-cost pricing.

Deviations from average-cost pricing are based on the possible necessity of meeting non-economic goals and considerations of innovational incentives. The examination of federal transportation policy evidenced the importance of non-economic, and often inconsistent goals included in regulation policy. Meeting such goals may require deviation from economic standards.

Encouragement of incentives to innovate is a major justification for deviation from the general pattern of average-cost pricing. To the extent that innovation is encouraged, a profit could be permitted to persist subject to slow disappearance. The commission would bear major responsibility for distinguishing innovational profits from those arising from restriction.

286 pages. $3.70. Mic 57-1237

MARXISM, COMMUNISM AND THE THEORY OF ECONOMIC DEVELOPMENT (PARTS I-III)

(Publication No. 19,469)

George L. Melville, Ph.D.
Indiana University, 1956

This study attempts to analyze objectively Marx's theories of social and economic development and the Russian theories which grew out of Marx's work. The study is divided into three parts: (1) Marxism; (2) socialist concepts of development in Russia, 1880-1917; and (3) problems of economic development in the Soviet Union, 1917-1932.

The analysis of Marxism in Part I supplies a frame of reference for the examination of the Russian concepts presented in Parts II and III. Marx's theory of historical materialism, while logical, can be found wanting in that the postulates upon which the theory rests have not been scientifically substantiated. The theory of capitalist development, which is designed to show that technological unemployment is the inescapable dilemma of capitalism, is based on a model too narrow to admit of general application to economic processes. In Chapter IV, a more

general model of economic development is presented to show the possibility of an equilibrium rate of growth, stagnation and technological unemployment.

The second part of the study analyzes the prerevolutionary formulations of Leninism, Menshevism and Trotskyism. Lenin is shown to have deviated from Marxism on key points defended by the Mensheviks. Trotsky is shown to have drawn the logical conclusion of the labor dictatorship which follows from the tactics proposed by Lenin. None of the Russian socialists prior to the Bolshevik Revolution envisioned the type of social and economic development which resulted from the revolution. Lenin foresaw capitalist development controlled by a political alliance of the proletariat and peasantry. The Mensheviks had no hope for such an alliance and stood for the gradual achievement of the "Minimum Program" in the normal course of capitalist development. Trotsky foresaw that the revolution would culminate in a labor dictatorship which would be preserved by socialist victories in the advanced western nations.

The problems which faced the Bolsheviks following the revolution are analyzed in Part III. The European socialist movement rejected Bolshevism and emphasized a more reformist path of development. Unable to secure economic and political support from Europe the Bolsheviks undertook to establish "socialism in one country." The theory of the vanguard party was extended to cover the right of the Communist Party to impose its programs by police action. An ideology was developed to disguise the transformation of the "workers' party" into a hierarchy whose members enjoyed political and economic benefits withheld from the masses.

The path of economic development worked out by the Russian communists must be regarded as a course which may be taken by underdeveloped areas in Asia and Africa. The problem of Western democracy vis à vis these areas is to develop and institute a positive program of development for these areas to check the growth of communism. The concluding chapter to this study analyzes this problem.

294 pages. $3.80. Mic 57-1238

CONCEPTS AND MEASUREMENT OF PRODUCTIVE CAPACITY (PARTS I AND II)

(Publication No. 20,171)

Edward Joseph Zabel, Ph.D.
Princeton University, 1956

This study is primarily concerned with the discussion, the development, and the evaluation of the usefulness of concepts of capacity in those areas of economic research where the idea of a capacity has played a significant role. The notion of a capacity has arisen frequently in economic analysis, but among economists it is still common to treat this concept gingerly. The problems of capacity arise initially when the term is not sufficiently qualified. Expressions in common use, such as "capacity," "capacity to produce," "industrial capacity," and "excess capacity" are not by themselves meaningful. When the ambiguity is removed it is seen that a capacity implies not a unique concept but an indefinitely large group of concepts. This conclusion is substantiated when it is shown that in various areas of research authors have rendered different interpretations of a capacity which are not always fully reconcilable. We argue, however, that the objectives of a study usually rather narrowly restrict the choice of a capacity concept, though in some existing studies the actual selections made are clearly inappropriate.

Separate analyses are made of industry measures of capacity and measures of capacity for an economic system. The importance of a capacity measure for studies of investment in durable production equipment is also discussed. For the industry, measures published in the trade journals are generally called technological measures of capacity and purport to show the maximum amount of output which can be produced during some period of time with the existing durable production equipment. On the basis of varying assumptions as to the availability of complementary inputs, the number of shifts worked by the labor force, the time allowed for maintenance and repair of machinery, etc., it is customary to classify technological concepts more finely. Three types of technological measures are frequently referred to: rated capacity, theoretical capacity, and practical capacity. We explore the use of such data for economic analyses.

Critical analyses are made of the major empirical studies of the economic system undertaken during the decade of the 1930's and it is argued that these studies were seeking to measure the preferred maximum combination of goods under conditions which involved changing the existing financial and economic institutions or with changes in the distribution of national income. We maintain that the studies have common faults which cause us to have but little confidence in the measures. The excess capacity thesis developed by Edward Chamberlin is discussed where the argument, according to Chamberlin, is that excess capacity, or waste, develops as a feature of long-run equilibrium whenever price competition fails to function among the monopolistic competitive group. We argue that, for a number of reasons, Chamberlin has not shown that price competition leads to ideal output nor that all other equilibrium positions under monopolistic competition lead to economic waste.

We begin the analysis of investment studies with a discussion of the acceleration principle and argue that in its simple form the principle is directly dependent upon two hypotheses. With an interpretation of capacity as being the desired level of capital goods we maintain that the excess capacity criticism and the recent attempts to develop a capacity concept for investment models relate to both these hypotheses. We also examine investment models which avowedly or implicitly develop from criticisms of the accelerator model and make a first attempt to construct a model on the basis of the previous analysis of investment equations. 281 pages. $3.65. Mic 57-1239

EDUCATION, GENERAL

A MANUAL OF CRAFT ACTIVITIES FOR SUMMER PLAYGROUND LEADERS AND CAMP COUNSELORS (PART I: THE RESEARCH. PART II: THE MANUAL.)

(Publication No. 19,980)

Kenneth R. Benson, Ed.D.
New York University, 1956

The increasing emphasis on, and interest in the crafts suggests the need for early direction of our youth towards the development of skill and understanding in this field of endeavor. Camps and playgrounds, recognizing the potentialities of craft activities, have incorporated these manipulative experiences in their programs. While much has been written about the crafts, little or no literature is available that expressly concerns itself with craft programs conducted in camps and on playgrounds. It is the purpose of this study to develop a manual of craft activities for summer playground leaders and camp counselors.

This research is in two parts: (1) To develop criteria for the selection of craft projects based on the characteristics of children, programs conducted in camps and on playgrounds and the background of leaders in these situations; (2) to illustrate, photograph and write the step-by-step procedures necessary to construct the selected projects.

Pertinent data were gathered from the literature concerning the characteristics of children between the ages of six to fifteen. Data concerning playground leaders and camp counselors were obtained from 1,004 completed questionnaires. Information pertaining to programs conducted on playgrounds and in camps was obtained by the questionnaire method. Sixty-three organizational and private camps, as well as sixty municipalities in the United States, cooperated by providing pertinent data concerning their respective programs. As an outgrowth of compiling this information criteria were developed for the selection of craft projects. It was felt that forty craft projects would be sufficient to provide for selective programming in the crafts.

Seventy-five projects were selected from the literature and 25 projects were developed by the investigator to fit the criteria. From this listing of 100 projects, forty were selected by a jury employing the developed criteria. The selected projects were illustrated. To determine the practicability of the projects they were constructed by typical playground leaders and camp counselors. By selective sampling and under counselor guidance every fifth project was constructed by children between the ages of six and fifteen.

Evidence indicates that crafts are part of the total activity programs conducted in camps and on playgrounds. The leaders conducting these programs have had little formal or informal training in the crafts, these leaders are principally college students in the fields of education and liberal arts. The crafts manual constitutes the major results of this study. The emphasis in the manual is on the forty craft projects that are suitable for use in camps and on playgrounds outside of craft shops.

403 pages. $5.15. Mic 57-1240

STANDARD MANUSCRIPT SCALES FOR GRADES I, II AND III

(Publication No. 19,485)

Diodato Bezzi, Ed.D.
The University of Oklahoma, 1957

Supervisor: Doctor Henry D. Rinsland

During the past fifty years much research has been done in the area of handwriting. Until 1920 educators taught only cursive writing; but when the merits of manuscript were seen, there was a rapid movement in many schools to adopt the print script method of writing.

Students of handwriting early realized that the most valid and reliable criteria for evaluating children's handwriting were handwriting scales, and during the past half century numerous handwriting scales were developed. The purpose of this study was to construct three manuscript scales, since there are no manuscript scales that measure both rate and five degrees of quality of manuscript writing for Grades I, II and III.

Sampling: Random stratified sampling was employed to select one hundred thirty schools. Letters were sent to the superintendents of the selected schools asking their cooperation in securing manuscript handwriting samples. Directions for giving the test were sent to the co-operating schools, and these tests were administered during the month of April, 1956.

Scoring for Rate: Those samples were discarded in which directions had evidently not been followed. The three tentative sets of rate-norm tables, one for each grade, were based upon the letter count in terms of letters per minute of the 7212 samples. The rate norms are expressed in raw scores, percentiles and T-scores.

Scaling for Quality: Fifty samples from each grade were selected by a systematic plan to assure normality in their distribution. The fifty samples in each of these three sets were identified by number and handed to judges for ranking, with full instructions as to procedure. The judges consisted of teachers from the particular grade level from which the samples came. In each grade those samples that received a designated mean rank were assigned a level of quality and appear as the scales of quality.

The three tentative quality rate-norm tables, one for each grade, were based upon teacher's opinions as to what elements constitute the five quality levels of manuscript

writing. The quality norms are expressed in raw scores, percentiles and T-scores.

Overlap in Quality: The overlap in quality of writing by the grades is very striking, but natural. There is a four-step overlap in the quality of writing between Grades I and II, and II and III.

Cross Validity: The proposed manuscript scales were cross-validated with a cursive scale. Eighty-four percent of the teachers in Grade I, II and III noticed that the manuscript writing was one quality level better than the cursive writing.

These standardized scales afford a means whereby the teacher, the pupil and the administrator may evaluate with a high degree of accuracy the manuscript handwriting of any pupil or group of pupils.

98 pages. $2.00. Mic 57-1241

A STUDY OF THE SUBJECT MATTER CONTENT IN BASIC BUSINESS AND ECONOMIC EDUCATION

(Publication No. 19,555)

Floyd L. Crank, Ph.D.
Northwestern University, 1956

Supervisor: Russell N. Cansler

This study was undertaken to determine the topics and the facts, principles, and concepts that are of greatest importance in the basic business and economic education of high-school pupils. Specifically, the study sought to determine (1) the subject matter topics as revealed by research studies, (2) the topics that business and professional men believe are of greatest importance, (3) the facts, principles, and concepts as used by textbook authors, and (4) the facts, principles, and concepts that parents believe are of greatest importance. The findings have implications for textbook authors, curriculum planners, and classroom teachers in their efforts to improve basic business and economic education.

A master list of topics was compiled from the findings of ten major research studies. This list was submitted to business and professional men who judged the importance of the topics. From the ratings of these judges, lists of essential, desirable, and probably desirable topics were derived. These lists were used as guides in developing a master list of subject matter facts, principles, and concepts, compiled from the analysis of twelve textbooks. This master list of facts, principles, and concepts was submitted to parents of Illinois high-school pupils to determine the items of greatest importance in basic business and economic education.

Responses from business and professional men and parents were analyzed to determine the important subject matter. The significant findings of the study are:

1. Analysis of ten major research studies produced 812 topics that can be grouped into 21 general areas. Business and professional men rated 233 (28.7 per cent) of these topics as essential and 566 (68.5 per cent) as desirable or probably desirable.

2. According to business and professional men, the areas that contained the highest percentage of essential topics deal with economics, economic employment, and personal-business law.

3. Analysis of twelve textbooks produced 4,970 subject matter facts, principles, and concepts. Nine hundred seventy, or 19.52 per cent, of these items were rated essential by 67 to 100 per cent of the parents who completed the checklists. Approximately 70 per cent of the facts, principles, and concepts found in textbooks were considered either essential or desirable by 90 per cent or more of the parents.

4. According to parents, the areas that contain the highest percentage of essential facts, principles, and concepts deal with economic employment, business law, consumer education, and general business information.

The findings of this study lead to the following conclusions and recommendations:

1. There is a substantial body of content in basic business and economic education that is important for all high-school pupils to understand in order to participate intelligently in the business and economic aspects of society.

2. The various aspects and the specific areas in basic business and economic education can be defined for the guidance of curriculum planners and teachers. Basic business and economic education curricula should be constructed around the general aspects of business law, business occupations and employment, consumer education, general business information, and economics, and the specific content should be selected from these general aspects.

3. Authors of textbooks in basic business and economic education must evaluate carefully the content of their books to make sure that all of the essential content is included and to eliminate unimportant content.

596 pages. $7.55. Mic 57-1242

THE PLACE OF INDUSTRIAL ARTS IN THE PUBLIC SECONDARY SCHOOL CURRICULUM IN TEXAS

(Publication No. 19,741)

Delbert Ammon Dyke, Ed.D.
George Peabody College for Teachers, 1956

Major Professor: Roosevelt Basler

The purpose of this study was to present a developmental picture of industrial arts since being introduced into the public schools as manual training soon after the Centennial Exposition in Philadelphia in 1876 to more recently accepted concepts of how industrial arts may be an integral part of the total educational program in the United States and especially in Texas. Materials concerning the developmental background of public education in the state of Texas and industrial arts throughout the United States and Texas were obtained through research in a number of professional books, bulletins, and periodicals. A review was made of the accreditation reports from approximately 1,200 school districts in the offices of the Texas Education Agency in Austin, Texas, for statistical data concerning current offerings and enrollments of industrial arts in Texas schools. The schedule of each school was analyzed to determine the industrial arts offering for the entire state. The findings of this survey were then compared with information in bulletins from the United States Office of Education containing data pertaining to offerings and

enrollment of industrial arts in the United States in 1934 and 1948.

Findings of the Study

The first school in Texas soil, other than missionary, was established in Laredo in 1783. The first public school was established as a result of legislation passed on January 31, 1854. The historic problem of Texas education has been the proper distribution of control between the local unit and the state agency.

The municipal junior college has been the outstanding new development in Texas public education since the 1920's. The recent Gilmer-Aikin Reformation increased the State School Board, merged all state educational departments under the Texas Education Agency, and assured teachers of a minimum salary.

The area of education known today as industrial arts had its beginning in the 1870's as manual training. The Arts and Crafts movement in the 1880's, Sloyd in 1890, Manual Arts in 1900, and Pre-vocation in 1910 made some contribution to the present concept of industrial arts in the form of objectives, teaching procedure, or a new idea concerning subject matter. Manual training in Texas was introduced into the schools of Austin in 1896 in compliance with the will of John T. Allan.

The present concepts of industrial arts are predicated upon the fact that children probably do their clearest thinking when engaged in constructive undertakings which are inherently interesting. The most widely used type of organization for today's school shopwork is the comprehensive general shop. This is referred to as exploratory industrial arts in Texas. At least four industrial areas comprise the recommended initial shop experience with a variety of materials to be available for experimentation.

220 pages. $2.85. Mic 57-1243

THE EFFECT OF THE IMMEDIATELY PRECEDING ENVIRONMENT ON STUDENT PERFORMANCE ON STANDARDIZED READING TESTS

(Publication No. 20,479)

Jesse Howard Garrison, Ed.D.
State College of Washington, 1957

A principle purpose of this study was to determine the effect of certain situations immediately preceding a reading test on the performance of students in the test situation. Since standardized tests are widely used to measure student progress as well as to evaluate certain aspects of teaching, it seems important to test any assumptions involved in the administration of these tests.

A variety of activities, frequent changes in activities, a friendly relationship with the teacher, and a feeling of success are widely accepted as some of the basic needs of students. This study will attempt to determine (1) whether a two hour period in which these needs are denied will significantly affect student performance on tests, (2) which denials appear to have greater effect and which students are most affected.

Four situations were utilized preceding the administration of the reading tests:

1. Normal Situation: One experimental situation characterized by a variety in learning activities, supervised recess and standards suited to the demands of the activity taking place.
2. Free Situation: A situation characterized by permissiveness, little sedentary activities, free play and a maximum of student selection of activities.
3. Restricted Situation: Designed to be the opposite of the free situation with little variety in learning activities, short recess, severe teacher attitude and mostly sedentary activities.
4. Failure Situation: Proceeds similarly to normal except it includes a period just preceding the test when students work on an arithmetic test over material too difficult for any of them to complete successfully.

Four subgroups formed as part of the study include the bright and slower groups formed on the basis of I.Q. and the secure and insecure group formed on the basis of teacher and principal judgment.

Eight classrooms were used in the study, four fifth grades with 90 subjects and four sixths with 108 subjects. The design used was the Graeco-Latin square. The data were studied by analysis of variance, t scores and analysis of variance by ranks.

The hypothesis that the immediately preceding situation would produce a significant difference in the students' performance in a test situation was supported at the .05 level of confidence. The other variables of test form, practice, and classroom were not measured as significant.

Further study of the data indicated that:

1. The free and restricted situations were both associated with a significant loss on fifth grade level but not on sixth grade level.
2. The failure situation was associated with significant losses on both grade levels. Throughout the study this situation produced lower results than any other.
3. The boys' performance was not significantly more affected than was the performance of the girls.
4. Although there were differences in the performance of the bright and slower students, especially regarding the failure situation, the study did not indicate significant differences in performance.
5. The students selected as insecure showed significantly greater losses in all situations on both grade levels than did the group selected as secure.
6. The fifth graders showed significant losses in both the free and restricted situations while the sixth did not. Both groups showed significant losses associated with the failure situation. The study did not indicate that either was more affected by the preceding environment.

111 pages. $2.00. Mic 57-1244

HYPOTHESES REGARDING PARENT PARTICIPATION IN THE WORK OF THE SCHOOL

(Publication No. 20,434)

Albert Grant, Ed.D.
Stanford University, 1957

Statement of Problem

This study seeks to develop a systematic framework of promising hypotheses suitable as the focus for later

research regarding ways parents can effectively supplement the instructional program of the elementary school. Specifically, it endeavors to generate tenable hypotheses that denote promising types of parent supplementation of school instruction and that would lend themselves to validational testing against criteria of pupils' educational growth and development.

Procedure

The literature on home-school relationships was examined for suggestions as to ways parents can extend their children's education. These suggestions were used in formulating tentative hypotheses regarding ways parents can effectively supplement school instruction in the major areas of the curriculum.

The resultant list of 111 tentative hypotheses served as the basis for two check lists. One of these was designed to secure ratings on the value of the techniques of supplementation which the hypotheses denote and was used to secure such ratings from 214 selected California school leaders and 240 selected California parent leaders. The other was designed to secure estimates of the extent to which parents typically supplement their children's school instruction in the ways denoted by the 111 hypotheses. It was used to secure such estimates from 230 selected California teachers.

The value ratings secured from the school leaders and parent leaders were used as the basis for selecting hypotheses that denote "probably significant" ways of supplementing school instruction. Similarly, the teachers' estimates were analyzed to determine which of the hypotheses denote types of supplementation that typically are not practiced by parents.

Results

Analysis of the check list responses of parent leaders and school leaders, showed that 99 of the 111 tentative hypotheses denote "probably significant" ways of supplementing school instruction. These 99 hypotheses were therefore considered classifiable as "tenable" for purposes of further research.

Analysis of the check list responses of teachers, showed that 88 of the 99 "tenable" hypotheses denote types of supplementation that typically are not now provided by parents. This finding was considered to be favorable in its implication for the probable practical value of further research on the validity of the 88 hypotheses.

Conclusions

The findings suggest the following conclusions:

1. The literature on home school relationships includes many untested suggestions on how parents can supplement the school's instructional program.
2. The 99 hypotheses which are based on suggestions in the literature and which in the opinion of parent leaders and school leaders denote "probably significant" ways of supplementing school instruction constitute a framework of "tenable" hypotheses suitable as the focus for later research on how parents can validly supplement the instructional program of the school.
3. Further research on the validity of the 99 hypotheses which parent and school leaders consider "probably significant" would be desirable. Because of the high potential practical value of the findings, this is particularly true of the 88 hypotheses which, teachers believe, are typically not now provided by parents.
4. The technique of developing promising hypotheses regarding an educational problem on the basis of (a) the recommendations that are made in the literature and (b) the ratings of educational leaders regarding the significance of those recommendations is a useful research device.

152 pages. $2.00. Mic 57-1245

A CONCEPT APPROACH TO THE TEACHING OF ALGEBRA

(Publication No. 17,571)

Lewis Edwin Hirschi, Ed.D.
University of Utah, 1956

Chairman: Leo G. Provost

The present study is an effort to investigate the effectiveness of two distinct methods of teaching first year algebra, each method employing unique materials and procedures adapted to its particular philosophy. One of the two methods is called the traditional method throughout this study while the other is termed the concept method. An effort was made to distinguish between the two methods not only by using different textbooks but by specifically identifying the characteristics of the teaching-learning situation in each case.

The specific questions which this investigation was designed to answer are as follows:

1. On the basis of comparable groups are there significant differences in achievement between the control and experimental classes when measured by the Special Testing Instrument designed for this study?
2. On the basis of comparable groups are there significant differences in achievement between the control and experimental classes when measured by the Douglass Standard Survey Test for Elementary Algebra?
3. If significant differences in achievement do exist between the control and experimental groups when measured by either of the aforementioned instruments, are these differences more or less significant with students above or below median ability?

A careful analysis of the findings appears to warrant the following conclusions:

1. The Experimental Method used in this study was definitely superior to the Control Method when the results were measured by the Special Test.
2. There appeared to be no significant advantage for either method when results were measured by the Douglass Survey Test.
3. The differences among instructors were not dependent upon methods for either the Experimental Group or the Control Group. Therefore, neither method appears to have been a handicap to the effectiveness of the teaching of any teacher.
4. The results of the Special Test showed that there were significant differences in favor of the

Experimental Method for all three teachers involved in the study.

5. The results of the Special Test showed that the Experimental Method was equal to or superior to the Control Method under the possible combinations of instructors and ability levels of students considered in the design of this experiment.

6. The differences between methods for the Special Test were traceable to the above median ability group and not to the below median ability group.

7. In the light of the previous conclusion the Experimental Method was superior for above median students but showed no advantage for below median students.

8. Since all of the items on the Special Test were within the scope of the usual first year algebra course and since the Experimental Groups were able to answer more of these items correctly than were the Control Groups, the Experimental Method appears to have been superior to the Control Method on the basis of real algebraic achievement.

9. There is no discrepancy in the fact that the Douglass Test and the Special Test correlated highly and yet the Experimental Group scored significantly higher than the Control Groups on the Special Test but both groups did equally well on the Douglass Test. This could be accounted for by the Douglass Test being less comprehensive than the Special Test.

10. Within the framework of the text, method, and technique of the Experimental Method employed in this study seems to lie the foundation for improved mastery of first year algebra on the part of the above median groups of students from which will likely come the expert in the field of mathematics and the mathematical sciences.

11. The individual results on both the Special Test and the Douglass Survey Test indicated that a large percentage of students showed so little achievement in the course of a year's instruction that the time consumed cannot be justified.

12. The results on the Special Test indicated that the more thorough treatment of fewer but larger concepts as used in the Experimental Method was conducive to better learning. It appears that students and teachers have become victims of an extensive and segmented scope which cannot be defended.

13. The text used in the Experimental Method with its unorthodox arrangement of topics seems to have been instrumental in producing results which indicate that the traditional sequence bears no halo.

14. The close paralleling of the concepts of algebra with those of arithmetic, as was done in the Experimental Test, may well have been a factor in the superior results obtained on the Special Test.

15. The classroom atmosphere of the Experimental Method could well have contributed toward the superior results obtained on the Special Test. This would seem to indicate that the usual formal and highly structured algebra classroom situation cannot be justified.

16. Since the amount of drill contained in the Experimental Test was so drastically curtailed and yet the results as shown on the Special Test were superior, it appears that much of the drill of the traditional course in algebra is unproductive of understanding and insight.

418 pages. $5.35. Mic 57-1246

A STUDY OF ATTITUDES AND INTERESTS CONCERNING THE AIR FORCE AS EXPRESSED BY THE CADETS OF THE MICHIGAN STATE UNIVERSITY AIR FORCE ROTC DETACHMENT

(Publication No. 20,075)

Robert W. Innis, Ed.D.
Michigan State University, 1956

The problem. This survey concerning the attitudes and interests of Michigan State University Air Force ROTC cadets was undertaken to:

1. Determine some of the interests of Michigan State University Air Force ROTC cadets and their current attitudes toward the Air Force ROTC detachment, Air Force career planning, and Air Force flying training.
2. Identify any weak areas in the Air Force ROTC program at Michigan State University and make recommendations for improvement.
3. Determine to what extent attitude questions differentiated between basic and advanced cadets.

Methodology, techniques, and data. The opinion-attitude questionnaire method was employed as the technique most appropriate for the approach to this problem. Questionnaires were formulated and administered to all of the one thousand basic cadets and two hundred advanced cadets. The purpose of the questionnaire was to obtain basic data concerning current attitudes in both groups.

The data used in the investigation were based on a stratified random sampling of three hundred of the one thousand basic cadets and a 100 percent response from the two hundred in the advanced group. Additional information was obtained from the junior summer camp rating forms, detachment records, and the results of the AFOQT battery administered by the 380th AFROTC detachment to all candidates for the advanced program during the academic year of 1955-1956.

The data were analyzed as recommended in Air Force Manual 40-1, Supplement 17, December, 1954, with the judgment analysis being made by the writer within the framework of what would be "good" or "bad" according to Air Force, AFROTC, and university regulations. A nomograph was used to assign discriminating values to individual alternatives and the chi square statistic was utilized to determine which questions differentiated between the basic and advanced cadets on the 5 percent level or better.

Findings and conclusions. The survey clearly indicated a large number of current attitudes of Michigan State University ROTC cadets. The questions concerning the military activities proved to be most valuable as they gave a definite indication of attitudes toward the Air Force in general, the Michigan State University Air Force ROTC detachment, Air Force career planning, and flying training. Many of the questions did tend to differentiate on the 5 percent level or better.

The general-attitude questions and physical considerations proved of little value, as about all they seemed to indicate was that the cadet corps as a whole was an exceptionally healthy group, and that they possessed many good air-age and American-type attitudes. These questions did not tend to differentiate between the two groups.

An analysis of the attitudes expressed indicated that many items were rated highly satisfactory, while others were rated weaker. The items rated weak definitely pointed the way for a program of improvement. Much of the improvement could be accomplished at the local level; however, some of the others would require action on an Air Force wide level.

Suggested improvements included increased emphasis on AFROTC instructor selection, in-service training, classroom procedures, academic grading, selection, attitude building, lesson planning, and motivation.

314 pages. $4.05. Mic 57-1247

PRACTICES AND CHARACTERISTICS OF THE FEDERALLY SUPPORTED, COOPERATIVE DISTRIBUTIVE EDUCATION PROGRAM IN PENNSYLVANIA, 1955-1956

(Publication No. 20,597)

Galen Victor Jones, Ed.D.
Temple University, 1957

The purpose of this study was to survey the distributive education program of Pennsylvania and to determine its practices and characteristics as of the 1955-1956 school year. Information was obtained on thirteen specific factors descriptive of these practices and characteristics. The factors were: support, administration, staff qualifications, student selection and guidance, work experience, coordination, public relations, curriculum, classroom and library, merchant cooperation, job opportunities, appraisal of class, and recommendations for improvement.

The four groups of participants most concerned with the program; namely, (1) local administrators, (2) cooperating merchants, (3) local coordinators, and (4) distributive education students, supplied the basic data of the study by means of responses to the questions on prepared inventory blanks. Eleven hundred and forty-seven completed blanks were tabulated, totals and response per cents were computed for each group, and tables were constructed to indicate the practices and characteristics revealed. In all cases where identical questions were asked of two or more groups concerning any division of the study, rho coefficients of correlation were computed on the rank order to present the extent of agreement. Mean rho scores computed by the Fisher z score technique were used to determine the findings of the recommendations for improvement factor.

The findings of this study indicated that all four groups of respondents were satisfied with the distributive education program to a high degree. Principals, coordinators and students reported 90 per cent and merchants 72 per cent satisfaction. Eighty-four per cent of the principals and 65 per cent of the merchants rated the coordinators' qualifications as either superior or excellent. Coordinators expressed a minimum of 90 per cent accomplishment of twelve student selection and guidance activities. Eighty per cent of the coordinators received help from school counselors in determining students' aptitudes for distributive training. Distributive education graduates were the most influential persons in students' decisions to apply for distributive education. Principals believed that coordinator and student contacts with merchants were important factors in improving public relations with the business community. Over-all achievement in public relations functions was rated low by most coordinators. Extensive use was made in all schools of audio and visual aids and of field trips to enliven the program. Lowest accomplishment with relation to the curriculum organization factor was reported in using follow-up studies of graduates as a guide to curriculum revision.

Seventy-five per cent of the merchants reported three ways in which their businesses cooperated with the local program: (1) by always employing a distributive education student, (2) by providing good supervision, and (3) by providing progressing training and experiences. Merchants reported limited job opportunities for advancement for graduating distributive education students. Of the 9 positions listed only that of salesman was indicated by more than 25 per cent of the merchants as being available to such students. On six points of appraisal, 40 per cent of the coordinators and 25 per cent of the merchants rated the 1955-1956 students as superior and about 50 per cent of both groups rated them as average.

The four groups of respondents agreed on three recommendations for improving the Pennsylvania program: (1) more widespread publicity was needed concerning the opportunities of distributive education and of the selling field, (2) the program would be improved if older students (possibly thirteenth or fourteenth year) were available to enrol, and (3) more student interest was needed if students were to take full advantage of the opportunities provided by their school and store work.

222 pages. $2.90. Mic 57-1248

LEARNING EXPERIENCES AND OUTCOMES OF A THREE-YEAR JUNIOR HIGH SCHOOL CORE PROGRAM

(Publication No. 19,749)

Joseph C. Jurjevich, Jr., Ed.D.
George Peabody College for Teachers, 1956

Major Professor: William Van Til

This was a descriptive and an evaluative study of a three-year junior high school core program. The group of students under study were members of a core class taught by the writer.

The descriptive aspect of the study was primarily concerned with the learning experiences of the study group for the three years of the junior high. A detailed description of the community, of the school and its program and of the students was also included.

An evaluation of the academic achievement and behavioral manifestations was made for each year of the junior high. A two and one-half year follow-up study in the senior high was made of the students who were in the ninth-grade core class.

The mean achievement of the study group in the junior high was compared to that of the same grade level in the school and in the entire city. In the senior high, comparisons were made with the class of which they were a part each year and with the total school population.

A modal teaching procedure was established for the other core classes in the system as an aid to the evaluation. This offered a comparison of the kind of core program used by most of the teachers of classes in the same grade level as the study group with the kind used by the study group's teacher.

Findings of the Study

A summary of the findings shows that the study group was not a select group. Ninety-four per cent of them were from the lowest three socio-economic classes in the city. The mean IQ was slightly below the norm for the study group in grades seven and eight and more than six points below it for grade nine.

The mode for the kind of core used for each of the three years of the junior high was more conservative than that used by the teacher of the study group.

In determining the growth of the study group for both years (grades seven to eight and eight to nine), the mean gain was more than one year in all areas except in reading for the first year. However, the mean score in reading was the highest of the three groups and above the norm for the test.

The study group's achievement in academic honors surpassed the comparison group in the junior high. Their behavior indicated that they were active, participating members of the school-community and readily assumed the obligation of exercising control over their own behavior.

The results of the comparison of the group's junior high school experience show their achievement to be almost always up to and slightly better than the achievement of the comparison group in the city. Judging from the evidence of the follow-up study in the senior high, it seems safe to conclude that the study group's junior high experience, in which the less conservative type of core program was used, was as good as and in some cases better than that of the other classes of the group's grade level as preparation for senior high.

The battery of tests taken by the study group and their class in senior high shows them to be below the norm for the class on the Differential Aptitude Tests. The total mean achievement in the other five tests of the battery shows them to be slightly above the class mean in academic achievement.

The behavior of the study group and their participation in school affairs in senior high indicate that they are up to and sometimes slightly better than the average student in these respects. 484 pages. $6.15. Mic 57-1249

AN HISTORICAL STUDY OF THE ORGANIZATION AND DEVELOPMENT OF STUDENT PERSONNEL SERVICES AT THE STATE COLLEGE OF WASHINGTON

(Publication No. 20,482)

Wilfred Mason Landrus, Ed.D.
State College of Washington, 1956

Designed to help record a unique story in the annals of student personnel work in higher education, and to contribute to a more complete understanding of the student personnel program at the State College of Washington, this study explores the organization and development of selected phases of this program from the founding of the College in 1891 to the end of President Compton's term of office in 1951. Included as background material are a chapter on the history of student personnel work in colleges and universities of this country, and a chapter containing an historical sketch of the State College of Washington through this period. Both of these chapters appear to be worthwhile contributions to the literature of higher education.

No hypothesis is defended, nor is claim made to have exhausted all sources, or to have included all factors which might be considered to be relevant to such a study. Certain general principles, or historical lessons, do seem to present themselves.

The main sources of material were primary in nature, including: regents minutes, faculty minutes, committee records, inter and intra-office communications, and testimony by first-hand witnesses. Among those sources more secondary in nature were published College reports, catalogs, staff bulletins, student publications, and early histories of the College.

Founded at a time when academic impersonalism was ascendant in higher education, the State College of Washington appears instead to have held quite consistently to what might be called a "student personnel point-of-view," or a concern for the welfare of the students. This concern evidently was promoted in part by a relative scarcity of students in a young and ambitious institution, and by its residence nature which favored close student and student-faculty relations.

Following World War II, a centrally administered and greatly expanded student personnel program was established on this campus, due in part to: student demand, a change in administration, the "G. I. Bulge," progress made in the pre-war student personnel program, recommendations made by faculty committees, and the climate of reorganization which prevailed at this college. Concurrent with these and many other changes wrought was the establishment of a deferred-major program to facilitate general education and to provide for unbiased, cross-departmental counseling.

Under the leadership of Hopkins, Bordin, Blaesser, Pepinsky and others, the student personnel program on this campus gained a reputation among those in the student personnel profession as being one of the best in this country. Much emphasis was given to integrating the student personnel and the academic programs. However, by 1948, growing faculty and administrative dissatisfactions with the deferred-major counseling program became evident. Charges were quite frequent that the student personnel program had been "ballooned" all out of proportion. Together with financial retrenchments in 1949 and 1951, these dissatisfactions and charges caused considerable change and reduction in this program--so much so that the general understanding among those in the profession was that it had "gone down the drain." Subsequent experience would indicate, however, that although much was lost, much remained.

Among the more important principles which the experiences of this College with its student personnel program would seem to point up are: (1) the need and opportunity of maintaining a training program for student personnel workers in a residence institution such as this one, (2) the advisability of giving college students as much

responsibility for the conduct of their own affairs as they appear ready to accept, and (3) the vital necessity of maintaining at all times the closest and clearest communications possible between administration, faculty and students on matters of mutual concern.

313 pages. $4.05. Mic 57-1250

A STUDY OF CHARACTERISTICS OF THE MICHIGAN PUBLIC SCHOOL TEACHING POPULATION BY ECONOMIC AREAS OF THE STATE

(Publication No. 20,213)

Carol L. Lutey, Ph.D.
Michigan State University, 1955

The purpose of this study was to provide basic and detailed information about the public school teaching population of Michigan by geographic sub-divisions of the state. A secondary objective was to indicate the use of such data in the identification and analysis of educational problems in the separate regions of the state.

The state was divided, on the basis of counties, into nine Metropolitan and thirteen Non-metropolitan Economic Areas which are substantially the same as those used for federal census tabulations. Teaching populations of Metropolitan, Non-metropolitan and separate Economic Areas were analyzed by the following factors: (a) types of school district in which teachers were employed; (b) dates of certificate; (c) types of certificate; (d) amounts of training; (e) institutions where work was completed for certificates; (f) teaching assignments; and, (g) four factors of teaching experience. These data were obtained from records maintained by the County Superintendents of Schools.

Detroit teachers were excluded from these analyses. The 39,935 teachers included in the study were estimated to represent 99.6% of the Out-state public school teaching population. Records for over 90% of these teachers were for the school year 1952-53, the remainder for 1953-54. For every characteristic analyzed, data were complete for at least 92% of the total teaching population, 90% of the teachers of each Metropolitan Area and 72% of the teachers of each Non-metropolitan Area.

Rank order correlation coefficients were computed for relationships between selected categories of most of the factors analyzed. Implications of the results of the study were discussed for the problems of: (a) school district organization; (b) present and future demands for teachers; and, (c) teacher training in state-supported higher education during the period of high demand for teachers. Data relative to school and community finance, population trends, and rates of school attendance for each Area were introduced into these discussions.

General Findings and Conclusions

1. Teaching populations of separate Economic Areas vary to a marked degree in most of the characteristics examined. In general, teaching populations of Metropolitan Areas include higher percentages of fully-qualified teachers and teachers having longer years of experience.

2. Teaching populations of most of the Areas tend to rank rather consistently as high, medium high, medium low or low for a majority of the characteristics examined.

3. Current problems of education vary to a marked degree in terms of their importance and their difficulty of solution in the various Areas of the state.

4. Reorganization of school districts is indicated for a number of Areas as a method of more efficient utilization of available funds.

5. Every Area of the state will experience problems in satisfying the increasing need for teachers, the combination of factors producing the need being unique for each Area.

6. All state-supported institutions which train teachers will be taxed beyond their present facilities if the increased demands for teachers are to be met. The extent of the demands upon each of these institutions will vary according to: (a) the nature and location of the institution; and, (b) trends in the percentage of the teaching population supplied by the institution over the past several decades.

220 pages. $2.85. Mic 57-1251

AN ANALYSIS OF SELECTED PRACTICES IN THE REQUIRED PHYSICAL EDUCATION PROGRAMS FOR MEN IN THE STATE TEACHERS COLLEGES OF THE NORTH CENTRAL ASSOCIATION

(Publication No. 20,483)

Luther A. McCown, Ed.D.
State College of Washington, 1956

Statement of Problem

The problem of this study was to ascertain the extent to which present practice with respect to required physical education in the state teachers colleges accredited by the North Central Association of Colleges and Secondary Schools complied with standards developed by leaders in the field of physical education.

Procedure

Facts about present practices in selected areas of the required physical education programs were obtained by means of (1) questionnaires, (2) college catalogs and bulletins, and (3) college visitations. Sixty-four questionnaires were mailed to the respective colleges, fifty-four were returned completed which was a return of 84.3 per cent. Catalogs were received from all sixty-four colleges.

Those practices were evaluated in terms of standards recommended by (1) W. L. Hughes, (2) Washington, D. C., 1954, Conference on College Physical Education, and (3) the Service Program-1955-Committee of the College Physical Education Association.

Recommendations, based on the standards and evaluated practices, were then made which may be used as administrative guides.

Summary of Findings

An evaluation, based upon the selected standards, of practices in certain areas of the required physical education program of the colleges studied shows the following:

1. In the area of time requirements, the extent of conformity between college practice and standards ranged from no college conforming to the standard calling for four

years of physical education to 100 per cent of the colleges conforming to the standard calling for the use of intramurals as supplementary activities.

2. In the area of program of activities, the extent of conformity between college practice and standards ranged from 22.2 per cent of the colleges conforming to the standard calling for the use of "highly desirable" activities to 64.8 per cent conforming to the standard calling for student election of activities.

3. In the area of classification of students, the extent of conformity between college practice and standards ranged from 27.8 per cent of the colleges conforming to the standard calling for grouping by both year in college and results of medical examination to 46.3 per cent conforming to the standard calling for homogeneous classifications within classes.

4. In the area of marks and credits, the extent of conformity between college practice and standards ranged from 26.6 per cent of the colleges conforming to the standard calling for students' marks to be based on achievement and knowledge to 79.6 per cent conforming to the standard calling for the same marking and credit system as other instructional areas.

5. In the area of absences and excuses, the extent of conformity to standards ranged from 51.8 per cent of the colleges conforming to the standard calling for valid student excuses to originate from the health service and/or the Dean of Men to 72.2 per cent conforming to the standard calling the physical education department to follow the college policy in regards to absences.

6. In the area of health examinations, the extent of conformity to standards ranged from 68.5 per cent of the colleges conforming to the standard calling for a health inspection following absences due to illness to 98.2 per cent conforming to the standard calling for a health examination for all entering students.

7. In the area of class sizes and periods, the extent of conformity between college practice and standards ranged from 24.1 per cent to the standard calling for three weekly meetings per class to 90.6 per cent to the standard calling for 30 minutes of instructional time per period.

8. In the area of financial support 88.9 per cent of the colleges conform to the standard calling for the source of such support to be the same as that for other instructional areas. 194 pages. $2.55. Mic 57-1252

A STUDY OF ADOLESCENT ADJUSTMENT USING SHAFFER'S POSTULATES AS A MODEL

(Publication No. 20,502)

Wilbert J. Mueller, Ed.D.
University of Kansas, 1956

Recent developments point to the acceptance by educator's of their responsibility to improve the social and emotional condition of children. Basic to this development is the widely recognized need for useful methods and techniques for understanding personality. This study was designed to shed further light upon adolescent adjustment and used Shaffer's theoretical postulates as a psychological model. The study used: (1) a "self-rating" Student Questionnaire to gain information about feelings, attitudes, and perceptions of adolescents, (2) a Teacher's Rating Scale for assessment of behavior characterizations, and (3) a Parent Questionnaire to gain additional information about a subsample of the population. Each technique was designed to shed light upon adjustment from an independent source.

The Student Questionnaire items were sorted by six psychologists into designated categories suggested by Shaffer. The students were each rated by four of their teachers in ten behavior traits: Inadequate-Adequate, Defiant-Amicable, Withdrawn-Sociable, Aggressive-Submissive, and "Nervous"-Calm. The parents rated their children on a thirty-five item questionnaire. The population of 414 pupils was drawn from eighth, tenth, and twelfth grades of three typical Kansas communities.

The first hypothesis tested Shaffer's theories concerning "sources of conflict" and use of "adjustment mechanisms." Analysis of data from the Student Questionnaire showed that the various items designated for particular source and adjustment categories were found individually to correlate highest with the assigned category as a criterion. The Student Questionnaire categories were tested for reliability and resulting coefficients were found of acceptable magnitude for identification of group differences. These data were accepted as "clinical validity" to the existence of source and mechanism categories suggested by Shaffer. The source categories retained were: Constitution, Philosophy, Family Relations, Non-family Relations, Sex, and Inadequacy. The adjustment mechanisms categories were: Fear, Withdrawal, Aggression, and Neurosis. Factor analysis of categories produced a general and two specific factors compatible with assumptions made by Shaffer.

The second hypothesis investigated similarity between behavior described by teachers and parents and that admitted by adolescents. Data showed that teachers were consistent in behavior ratings of students and that the ratings were essentially in agreement with similar behavior characterizations admitted to in the Student Questionnaire. Numerous items from the Student Questionnaire were found to be significantly related to Teacher's Rating Scale categories. Factor analysis of the Teacher's Rating Scale categories also produced a general and two bipolar factors. Because of the small number of ratings provided, the Parent Questionnaire data were found inadequate for extensive use. They were, however, analyzed by four psychotherapists. This resulted in a classification of some of the questionnaires into two groups based on judged "satisfactory" or "unsatisfactory" parent-child relationships. There were some significant differences in the profiles of the two groups.

The third hypothesis investigated sex and age differences. The data from the study showed significant age and sex differences in the responses to individual items as well as clusters of items which composed the various categories in both the Student Questionnaire and the Teacher's Rating Scale.

To find behavioral characterizations common to both the Student Questionnaire and the Teacher's Rating Scale, the scores of the various categories were correlated and resulting coefficients showed a significant relationship between behavior rated by teachers and behavior admitted by students. Factor analysis produced six factors. The first two, when rotated, appeared as related factors and were assumed to be the same as general factors in the

Student Questionnaire and the Teacher's Rating Scale. The remaining factors appeared as: defiant-aggressive-"nervous" behavior, adequate-sociable-calm behavior, a philosophy-sex value system, and inadequate-neuroticism behavior.

The possibilities for future research raised by the study fall into two major heads: research involving (1) longitudinal development of adjustment through the adolescent growth period, and (2) the clinical use of the Student Questionnaire for validating studies.

324 pages. $4.15. Mic 57-1253

SOCIAL SCIENCE GENERALIZATIONS FOR USE IN THE SOCIAL STUDIES CURRICULUM: TRANSPORTING PEOPLE AND GOODS

(Publication No. 20,438)

John Franklin Rambeau, Ed.D.
Stanford University, 1957

Purpose of the Investigation

This dissertation was one of a series of studies constituting a group investigation concerned with the identification of social science generalizations for possible use in the social studies curriculum. This particular dissertation undertook to identify generalizations concerned with man engaging in one of his basic activities, transporting people and goods. Through an analysis of selected literature in the disciplines of anthropology, economics, geography, political science, social psychology, and sociology, and also from the field of transportation, generalizations were identified and extracted. These statements were then classified and organized in useful categories so as to serve as a basic resource to educators and others concerned with the development of social studies curriculum and instructional materials.

Procedures

1. The first step in the research was the compilation of a selected bibliography from the six social science disciplines, and a selection of texts from the field of transportation. This involved (1) collection of an initial bibliography; (2) selection of specialists; (3) rating of the bibliography by specialists; and (4) final selection of references. Criteria were established for selection of specialists and for rating of the bibliography. Ultimately, a total bibliography of forty-six texts was selected.

2. For purposes of this study a generalization was defined as a "universally applicable statement at the highest level of abstraction relevant to all time or stated times (as prehistoric) about man past and/or present engaging in the basic human activity of transportation." A series of pilot studies assured a high degree of objectivity and uniformity in the collection of data. Several examples of generalizations identified in the study follow:

"The economic and social progress of any group depends upon the reduction of the inconvenience and cost of overcoming space."

"Air transportation has become an indispensable instrument for the promotion of international trade and foreign investment."

"The growth of large cities in a modern, industrial society results from the territorial division of labor, large-scale production, and exchange of goods which cheap and efficient transportation makes possible."

3. The final bibliography was subjected to intensive analysis. Identified generalizations were recorded and coded. Approximately 700 generalizations were selected from the text material.

4. The generalizations were then categorized through an analysis of the data in terms of the frequency of recurrence of major ideas and the establishing of discrete categories suggested by this incidence.

5. The researcher then located and brought together those generalizations for which, in whole or in part, comparable statements were found. This synthesis resulted finally in 423 generalizations.

Conclusions

1. For the first time, this study provides an extensive listing of significant generalized ideas concerning man engaged in the transportation of people and goods. In essence, the study makes available a portion of the cultural heritage recorded in the social sciences, but not available in a readily usable form.

2. This research may provide educators with "anticipated outcomes of instruction" in the social studies which furnish both instructional foci within each teaching unit and a frame of reference against which they can plan learning experiences, adapt teaching methods, and select instructional materials.

3. This research may be of value to state and local committees concerned with the development of social studies curriculum.

4. Writers of texts and other instructional materials may find use for the data in the preparation of their materials.

5. This data should provide a reference for the evaluation of textbooks, resource bulletins, audio-visual aids, and courses of study. 191 pages. $2.50. Mic 57-1254

VOCATIONAL ADJUSTMENT PROBLEMS OF MIDDLETOWN YOUTH: IMPLICATIONS FOR IMPROVEMENT OF THE SECONDARY SCHOOL PROGRAM IN MIDDLETOWN, NEW YORK

(Publication No. 20,290)

Stanley Lamont Raub, Ed.D.
New York University, 1956

The purpose of this investigation was to determine, through the opinions, ideas, and experiences of graduates and drop-outs of the Middletown High School, the effectiveness of the secondary-school program in helping youth to solve problems in the world of work. A questionnaire study was conducted among graduates and drop-outs for the school years 1951 through 1954. Recommendations were made for improvement of the secondary-school program where an interpretation of the results of the study

indicated that the program was not meeting the needs of the young people in their post-school lives.

Important procedures utilized in the collection of data were as follows:

1. A Community Occupational Survey was conducted to question employers in the city about their present employees, the existing jobs in their businesses, and their plans for expansion or contraction within the next five years.
2. A questionnaire was constructed and sent to three hundred and eighty seven graduates and three hundred and seventeen drop-outs. Eighty-two per cent of the graduates and thirty-seven per cent of the drop-outs returned the questionnaires. Data were recorded in tables separately for graduates and drop-outs.
3. The data were analyzed and evaluated to determine in what ways the program of the secondary school did or did not help the young people to solve problems in their adult lives.

An analysis of the responses of graduates and drop-outs indicated the following findings:

1. The graduates and drop-outs felt that many of the occupational and educational adjustment problems which arose could have been partly solved by more adequate guidance and counseling information while they were still in school.
2. The graduates and drop-outs suggested more practical instruction, new courses, placement services, work experience, better relationship between teacher and student, more student responsibility, smaller classes, and more consistent school discipline.
3. The extracurricular program was not meeting the needs of a large segment of the school population.

Recommendations for improvement of the school program based on an analysis of responses of graduates and drop-outs follow:

1. The Social Studies Department of the high school might thoroughly re-examine its program to meet some of the criticisms of former students.
2. The typing program of the high school should be expanded to be available for election by all students.
3. The English Department should consider re-examination of certain phases of the English courses offered--especially that of creative writing.
4. The High School Curriculum Committee should evaluate the unit on consumer economics.
5. The High School Curriculum Committee should give their attention to the criticism offered by the former students concerning the inadequate preparation in health, marriage and family life, wise use of leisure, and participation in community affairs.
6. Consideration should be given by the faculty and administration to include extracurricular activities in the regular school day.
7. The educational, vocational, and personal guidance program should be improved.
8. Each student should have the opportunity for personal conferences with a qualified counselor to discuss vocational and educational plans.
9. All appropriate test data should be properly recorded and made available to staff members.
10. A placement service should be established to meet student placement needs.
11. The administration of the Orange County Community College and the Middletown High School should meet to work out a plan by which the staffs of each institution would become better acquainted with each other's program.
12. A work experience program should be initiated for all those students who desire it.
13. The High School Curriculum Committee should look into the possibility of enlarging the vocational offerings to meet the needs of the young people.

206 pages. $2.70. Mic 57-1255

THE STATUS AND IN-SERVICE EDUCATION OF COUNTY SUPERVISORS IN THE SOUTHEASTERN STATES

(Publication No. 19,761)

Elsie Neoma Schurter, Ph.D.
George Peabody College for Teachers, 1956

Major Professor: Maycie K. Southall

The purpose of this study was to determine the status of supervision and recommendations of supervisors and educational leaders for the in-service education of general supervisors in county school systems of the Southeastern States.

The data were secured from: (1) a questionnaire answered by 370 supervisors, (2) another answered by 57 selected educational leaders in supervision and curriculum, (3) an interview with a representative of each state department of education.

Treatment of Data

Information from interviews was used as background material. Frequency tabulations were made of all data from questionnaires. Further treatment of the rated material included: (1) computing group scores, (2) bringing scores to a basis comparable to that of all respondents marking each item, and (3) transmuting scores to a common measure called the merit score.

Findings

Status of supervision. Approximately half of the counties in the Southeastern States employed general supervisors. In one state supervision was required in order to receive state school funds. In general the state provided financial assistance and established standards while counties shared the cost and employed the supervisory personnel.

Supervisory personnel. The majority of the supervisors were mature women, were born in the rural South, were married and owned homes, with nearly half having dependents. Over three-fifths had master's degrees from accredited institutions. The majority had more than twenty years of experience, had taught in elementary schools, and had been principals. Over half had supervised five or more years. Approximately two-fifths had been in their present positions at least five years.

Conditions for supervision. The majority shared an office and had inadequate secretarial services. Almost half had responsibilities for distributing textbooks. More than half worked with 100 or more teachers in school

systems of 3,000 or more pupils. Most had the same tenure, leave, and retirement provisions as teachers.

Competencies recommended. Educational leaders agreed on the importance of supervisors possessing the following competencies: having a sound philosophy of education, understanding child development, utilizing human and natural resources, applying intelligence to the solution of problems, and being able to co-ordinate the efforts of others. Supervisors emphasized the importance of good human relationships, encouraging the creativity of others, and understanding human development.

In-service education program. A majority of the co-operating leaders and supervisors considered a master's degree and four or five years of teaching experience as minimum requirements for certification of supervisors. The majority of both groups recommended a co-operatively planned in-service education program which would include an induction period, participating in meetings and workshops, using consultative services, visiting other systems, and reading.

The leaders gave high rating to salaries in keeping with those of other professional workers, participation in policy making, provision for adequate office space and clerical help, and freedom from nonprofessional responsibilities.

Most supervisors recommended a twelve-month salary schedule comparable to that of principals, co-operation with curriculum groups, and expenses to professional meetings.

Recommendations

1. Supervisory services should be extended to all county systems through state salary schedules which counties could supplement.
2. Minimum qualifications should include the master's degree in supervision and four or more years of successful teaching experience at the level supervised.
3. Supervisors should have private offices, clerical help, and reimbursement for professional expenses.
4. A continuous in-service education program including an induction period should be co-operatively planned. Both should offer workshops, conferences, other supervisory techniques, and facilities for developing competencies of supervisors.
5. Local, state, regional, and national administrators should plan co-operatively with supervisors for their growth and improvement in educational leadership.
6. Research is needed to determine optimum supervisory loads with reference to grades, number of schools, and number of teachers. 352 pages. $4.50. Mic 57-1256

THE DEVELOPMENT OF A MERCHANDISE EDUCATION COURSE OF STUDY FOR NEW YORK CITY HIGH SCHOOLS

(Publication No. 20,003)

Arnold H. Scolnick, Ed.D.
New York University, 1956

Chairman: Professor Herbert A. Tonne

The purpose of this research study was to develop a course of study in merchandise education for use in the secondary schools of New York City which would meet the needs of the students enrolled in the program as well as the classroom teachers charged with its implementation.

The first phase of the investigation was concerned with determining the areas of merchandise education to be included in the proposed syllabus. Categories of merchandise were evolved in order to make the solution of this subsidiary problem feasible. Interviews with ten classroom teachers of merchandise education contributed greatly to the objectivity and validity of the categories which were finally developed.

In order to ascertain which of the established categories would best serve the needs of the students enrolled in a merchandise education program the investigator solicited the opinions of the teachers of merchandise education and organizations interested in consumer welfare. A checklist type of questionnaire was employed for the purpose of obtaining the required data. An analysis was made of the validity and reliability of this instrument.

No pretense was made that these sources were absolute and exact sources for determining what should be included in the merchandise education program. However, the investigator held that from these sources a better picture of consumer needs could be drawn.

Criteria were established to give added significance to the categories which were finally evolved. Nine areas of merchandise education of the forty listed met all the criteria established for inclusion in the proposed syllabus.

The next phase of the study was concerned with the determination of the kinds of learning experiences which would contribute to the intelligent consumption of merchandise. Categories of learning experiences were developed to facilitate the culling of the required information. A group of experts in the merchandise education field was surveyed, and their responses helped to establish the validity of these categories. The professional literature in the field of business education, consumer education, and merchandise education was surveyed using the categories of learning experiences as a frame of reference for gathering the necessary data.

While surveying the professional literature, the investigator also listed possible objectives for the proposed course of study. These were incorporated into a questionnaire which was sent to the Director of Business Education and all teachers of merchandise education. The organization of the course of study was within the scope of the objectives which were selected.

The final phase of the study was concerned with the planning, preparation and writing of the manuscript for the proposed syllabus which consisted of an introduction and nine resource units. A tentative resource unit on coats and suits and the orientation to the syllabus were submitted to a jury of experts in the field for the purpose of ascertaining whether or not these sections of the syllabus would achieve the goals of a consumer-oriented merchandise education program. The jury was unanimous in its acceptance of these sections of the syllabus, and commended the contribution this syllabus would make to the field of merchandise education.

Although no complete and final conclusions emerged from this study, it was found: that teachers recommended for inclusion in the syllabus those areas of merchandise education with which they were familiar; that all but one of these selections were validated by consumer organizations; that the desired objectives of the program could be

achieved by a subject centered approach; and that a syllabus consisting of a series of resource units would meet the needs of the students as well as the teachers charged with implementing the merchandise education program.
423 pages. $5.40. Mic 57-1257

A STUDY AND AN EVALUATION OF THE HEALTH EDUCATION PROGRAMS OF THE SECONDARY SCHOOLS OF SUFFOLK COUNTY, LONG ISLAND, N. Y.

(Publication No. 17,674)

John S. Sinacore, Ed.D.
New York University, 1956

The purpose of the study was to establish a set of principles and standards by which to judge programs in health education, survey the health education programs in the secondary schools of Suffolk County, evaluate them in the light of the established set of principles and standards, and make recommendations concerning them.

The set of principles and standards were formulated after a careful study of the available literature. The principles and standards were then submitted for approval to a jury of ten authorities in the field of health education.

In surveying the health education programs of the secondary schools of Suffolk County, this investigator interviewed principals and teachers of health education concerning the nine areas of the program. These are: 1) Teacher preparation 2) Time allotment 3) Needs and interests 4) Course content 5) Methodology 6) Facilities and equipment 7) Community resources 8) Coordination of program and 9) Administration. In order to have a complete picture of all the health instruction in the curricula of these schools, questionnaires were left with the principals to be filled in by their teachers of science, home economics and social studies. The questionnaires were designed to determine the amount and nature of the health instruction in these courses.

The evaluation of the health education programs by the established set of principles and standards revealed some significant incompatibilities:

1. Personnel assigned to teach the health courses were in the majority of instances unqualified according to the standards of the N. Y. State Education Department.
2. The time allotted to the health course was in most cases inadequate.
3. The relationships of health education to biology and physical education were confused and in many instances exaggerated by school personnel.
4. The contributions made in the area of health education by such courses as social studies, general science and home economics are inadequate when they are expected to take the place of a health course.
5. A small number of schools utilized community resources as part of the health instruction program.
6. Only a few schools made an effort to coordinate the health instruction in the health course with the other related subject areas.
7. The establishment of a broad and functional program of health education is primarily a responsibility of the administrator. Because of recent developments in the field of health education and because of the lack of pre-service preparation in this area, most administrators have deficiencies which inhibit them from providing the kind of health leadership needed.

It is recommended that through those agencies available, that all school personnel be better informed as to the nature, scope and significance of an adequate health education program. 96 pages. $2.00. Mic 57-1258

THE FUNCTION OF MUSIC IN THE COLLEGE CURRICULUM OF GENERAL EDUCATION

(Publication No. 17,592)

Jack Paul Swartz, Ed.D.
The University of Nebraska Teachers College, 1956

Supervisor: Doctor Frank Ernest Henzlik

The Purpose and Procedure of the Study

The purpose of the study was to determine how an educational music experience might function more effectively in achieving the objectives of general education. This involved: (1) an investigation of the literature concerning general education in an attempt to determine the outcomes expected from such learning; (2) a determination of those objectives relating aesthetic experience to desired outcomes; (3) a determination of the significance of music in general education; (4) a determination of those music functions which best contribute to the general objectives; (5) an identification of music activities and relating them to the broader objectives of general education; and (6) an analysis of freshman opinions in an attempt to substantiate the recommendations by which educational music experience might become more meaningful for general college students.

Survey of Literature

A survey of the literature pertinent to this field indicated the need for deriving course objectives and methodology from a number of sources such as: the needs of students and society, the recommendations of curriculum authorities, a consideration of the psychology of learning, and the findings of educational research. In addition these major issues were proposed: (1) that the general education courses should be specifically planned in harmony with the objectives of general education, (2) the same for all students, (3) required of all students, and (4) should cut across fields of knowledge.

These principles for developing music in a general education program evolved from the literature: (1) relevant music experiences must be built around the student needs and in terms of the students' past and immediate experience and his environment; (2) the primary aim is to deepen student responses to music; (3) values are learned through satisfying experiences in music; (4) establishing a point of contact in the life experiences of individual students is a fundamental element in such curriculum development; (5) music experiences help understanding and

enjoyment best when the initial experiences are with contemporary types related to the familiar world of students.

Psychological aspects of emotion and feeling were found to be prime considerations in selecting and directing learning in music listening.

Inventory of Student Opinion

An attitudinal inventory developed for studying the opinions of college freshmen, regarding music in their lives and education, was constructed from the statements of 98 freshmen in the Teachers Colleges at the University of Nebraska and the Arizona State College at Flagstaff. In January, 1956, 577 freshmen at the two institutions reacted to the statements and otherwise indicated their attitudes about various aspects of music. Several indications of significance to curriculum development were predominant: (1) most freshmen are cognizant of the functional values of music in their lives; (2) there was almost a unanimous preference for the "hit-parade" type of popular music but there also was an indication of an all-inclusive range in differing degrees of likes and dislikes of other music listening types; (3) there was less prejudice toward "classical" music than that which is usually assumed; (4) a significant minority exhibited both an avidness for and prejudice against folk, Western, and hillbilly music; (5) there was less prejudice shown against opera than past observation has indicated; (6) agreement as to the need for college music experience was not balanced by student approval of compulsory music courses; (7) students were interested in music for what it had to offer in bettering everyday living; (8) students exhibited a preference for music activity organizations over formal, required courses as the major music provision for general students.

The nature of class experience agreed to by the majority was in substantial agreement with that advocated by educational psychologists and inherent in the principles of general education.

Conclusions

The problems existent in the general education curriculum of music are mostly concerned with attitudinal aspects of learning. Music-learning curriculums should be developed with immediate and cultivated attitudes as the major elements around which the learning experiences are planned, constructed, directed, and experienced by students. Such curriculum necessitates evaluating the attitudinal status of individual students to enable effective development of formal courses around the personal and social needs of general college students, the social needs of the group, and the needs of a democratic society in general. 223 pages. $2.90. Mic 57-1259

A READABILITY FORMULA FOR THE ELEMENTARY SCHOOL BASED UPON THE RINSLAND VOCABULARY

(Publication No. 20,569)

Edward Barrett Tribe, Sr., Ed.D.
The University of Oklahoma, 1957

Major Professor: Dr. Henry D. Rinsland

Previous investigations in the field of readability that result in a readability formula have been based either entirely or partly upon the vocabularies of Thorndike. These vocabularies are either those of adults or a combination of adults' and children's vocabularies.

This study is based upon Rinsland's A Basic Vocabulary of Elementary School Children.[1] The Rinsland vocabulary is valid not only because it is drawn from children's oral and written vocabularies but also because of the sampling which involved a cross-section of all types of schools and all types of writings of children. From this syntactical vocabulary, a basic reading vocabulary has been prepared.

The purpose of this study is to develop a readability formula that will predict the approximate grade level of elementary school reading material based upon this vocabulary.

The method employed involves a multiple correlation between criterion elements and children's standardized scores.

The standardized instruments employed are the McCall-Crabbs Standard Test Lessons in Reading.[2] The reading score of a child is taken as one-half of the correct answers on random-selected lessons for grades two through eight. This score is the criterion.

The criterion elements counted in the selected reading lessons were: (1) average sentence length; (2) per cent of different words; (3) per cent of prepositions; (4) per cent of simple sentences; (5) per cent of different words not on the basic list; (6) per cent of polysyllabic words; (7) per cent of different words on the basic list.

By using the Wherry-Doolittle method,[3] the per cent of different words not on the basic reading vocabulary, X_5, was selected as the first variable correlated with the criterion .730. The further application of this method selected the second variable, X_1, or average sentence length. The multiple correlation became .761. With the addition of the third most significant variable, X_1, or per cent of simple sentences, the multiple correlation was increased to .764. This was not a significant increase. Therefore, the selection of further variables was stopped with the multiple correlation of .761.

The final result of the application of the Wherry-Doolittle selection method was the following multiple regression equation representing a readability formula that will predict the approximate reading level of material for the elementary school when C_{50} is the criterion:

$$C_{50} = .0719X_1 + .0143X_5 + 2.9347$$

87 pages. $2.00. Mic 57-1260

1. Henry D. Rinsland, A Basic Vocabulary of Elementary School Children (New York: The Macmillan Company, 1945).

2. William A. McCall and Lelah Mae Crabbs, Standard Test Lessons in Reading (New York: Bureau of Publications, Teachers College, 1950).

3. Henry E. Garrett, Statistics in Psychology and Education (4th ed.; New York: Longmans, Green and Company, 1953), pp. 404- 418.

EDUCATION, ADMINISTRATION

RECOMMENDATIONS FOR THE ADMINISTRATION OF THE NEW PALTZ STATE TEACHERS COLLEGE SCHOOL CAMP

(Publication No. 19,979)

Merrill Hamilton Archard, Ed.D.
New York University, 1956

Chairman: Professor Milton A. Gabrielsen

This study is concerned with making recommendations for the administration of the proposed New Paltz State Teachers College school camp. Although this study may be applicable to any State Teachers College in New York State, it was the purpose of the investigation to propose a plan for initiating a school camp at one selected State Teachers College in New York State.

Chapter IV is concerned with stating the educational objectives of New Paltz State Teachers College and its Campus School, with describing the events leading up to the acceptance of these objectives by the faculty, and with verifying that these objectives represent the educational purposes of the school.

Chapter V states and documents forty-three potential contributions that school camping may make to the educational purposes of the school. This chapter also gives the reader some background regarding the philosophy of school camping, its impact on American education, and its place in teacher-education.

Chapter VI shows how the potential contributions of school camping might help to meet the stated educational objectives of New Paltz State Teachers College and its Campus School. This chapter also has as its purpose to validate the forty-three potential school camping contributions that were stated in chapter V. To determine the validity of the potential school camp contributions and also to determine the validity of the relationship of the potential school camp contributions to the educational objectives of the New Paltz State Teachers College and its Campus School, a table was constructed which was sent to five jury members.

Chapter VII describes the factors which may influence the establishment and administration of the New Paltz State Teachers College camp. Most of the factors described in this chapter are peculiar to New Paltz, although other factors such as legislation are included.

Chapter VIII states seventy-three guiding principles concerning the establishment and administration of a school camp sponsored and operated by a State Teachers College. The writings of the recognized leaders in the field of camping, in general, were used as one source for the development of the principles. The publications of the American Camping Association were another source of data as were the reports from the Committee on Camping Education of the American Association for Health, Physical Education and Recreation, and the Committee on Camping and Outdoor Education of the New York State Teachers Colleges. Interviews with certain leaders of the six New York State Teacher College camps were another source for the development of the principles. A compiled list of the seventy-three principles that were developed from the above sources was organized in table form and sent to a jury of five for validation.

Chapter IX makes recommendations for the administration of the proposed New Paltz State Teachers College camp. These recommendations are based on the data contained in chapters IV, V, VI, VII, and VIII. Recommendations are made for the following areas:

1. Selection and Preparation of Leaders
2. Finance
3. Selection of the Campsite
4. Development of Facilities
5. Health and Safety
6. Food Management
7. Business Administration
8. Administrative Organization
9. Program Planning

The recommendations that were made by the investigator in the above areas were revised after a group conference with seven members of the faculty of the New Paltz State Teachers College. These revised recommendations appear in the final pages of the document.

443 pages. $5.65. Mic 57-1261

A STUDY OF SOME GUIDING PRINCIPLES TO BE USED IN DEVELOPING A HANDBOOK FOR ADMINISTRATORS

(Publication No. 20,600)

Curtis Cedric Baker, Ed.D.
University of Arkansas, 1957

Major Professor: Roy B. Allen

The purpose of the study was to develop some guiding principles which can be used in the development of a handbook for administrators. The paucity of reference materials and the lack of related studies limited the investigation to a study of current publications and a review of opinions of persons concerned with actual administrative practices.

With the development of state departments of education, there has been an increase in the functions and services of the department to the local public school districts. One of such services is the preparation of publications which are designed to improve the efficiency of the administration of the public schools. With these things in mind, there seems to be a need for a handbook for administrators.

The first phase in the investigation was an analysis of the contents of state department of education handbooks for administrators now in use in the forty-eight states of the United States. Pertinent items which seemed to be characteristic were selected and classified. The second phase was an examination of current literature and other related studies.

The third phase was the development of an opinionnaire

on the following bases: (1) personal opinions which were the result of a development of some underlying philosophical principles of state department of education services, (2) pertinent items which appeared to be characteristic in the handbooks examined, and (3) a survey of literature. Each of the statements had a provision for choices and comments. Of a total of 394 opinionnaires mailed to superintendents of schools in the states of Arkansas, Missouri, Kansas, and Oklahoma, responses were received from 263. This was a return of 67 per cent.

CONCLUSIONS. The information obtained from the analysis of the handbooks and from the respondents of the opinionnaire was compared and the following conclusions were made:

1. Each state should develop a handbook for administrators under the leadership of the state department of education.
2. The handbook for administrators should be published in a single volume which contains materials applicable to each area in public school administration.
3. An individual should be assigned the responsibility to coordinate the development of the handbook initially, and keep it current after the initial development.
4. The committee approach which utilizes group thinking should be used in the development of the handbook.
5. The handbook should contain items which have been established through continued practice and vitally affect the operation of the school at the time of publication.
6. The handbook should be adopted officially by the State Department of Education and become a part of its official records.
7. The handbook should be a bound publication and not too voluminous.

RECOMMENDATIONS. The following recommendations were made with respect to the steps a committee may use as a guide in developing policies which go into a handbook for administrators:

1. Examine the minute books of the State Board of Education and abstract all resolutions approved by the Board that can be considered as policy.
2. Classify the policies into areas that affect the various levels and phases of school operation.
3. Submit the committee's proposed general outline and content of the new publication to a representative sampling of administrators.
4. Write a proposed final draft of the general outline and content of the new publication.

193 pages. $2.55. Mic 57-1262

A FUNCTIONAL ANALYSIS OF THE DUTIES AND RESPONSIBILITIES OF SUPERINTENDENTS OF SELECTED PUBLIC SCHOOLS IN MISSOURI

(Publication No. 20,747)

Clifton Reed Bell, Ed.D.
Washington University, 1957

Chairman: Dr. Charles A. Lee

This study was directed toward obtaining essential information concerning the superintendent of schools in Missouri. The major purposes of the study were as follows: (1) to determine the professional qualifications and experience of selected superintendents in Missouri; (2) to indicate certain of the duties and responsibilities of the superintendent, and the amount of time devoted to the execution of such duties; (3) to show relationships existing between the time spent in performance of these duties, and such factors as professional experience, and school enrollment; and (4) to determine the extent to which Missouri superintendents have accepted democratic practices in school administration.

The basic research instrument used in the study was an information blank sent to one hundred sixty-seven superintendents in Missouri, with one hundred thirty-five or 80.8 per cent contributing usable data. The questionnaire was supplemented by interviews with thirty-five superintendents who had returned the original blank.

The following criteria were used in the selection of superintendents for study: (1) superintendents whose secondary schools were members of the North Central Association; and (2) superintendents of those schools classified as AAA or AA by the State Board of Education, with the exception of St. Louis and Kansas City.

For comparative purposes the schools were divided into five groups according to school enrollment. The superintendents who participated in the study were placed in three approximately equal groups according to their years of professional experience.

The basic factors considered in the presentation of the material were: (1) size of school enrollment; and (2) years professional experience of the superintendent. The following data were utilized in the study: (1) the median age, professional experience, and preparation of the superintendent of schools; (2) the attitude of the superintendent toward his job, and the adequacy of his preparation; (3) the percentage and amount of the superintendent's time devoted to eight major functions; (4) the superintendent's opinion concerning the percentage and amount of time devoted to major duties; (5) the days per annum and hours per week devoted to performance of specific tasks; (6) the superintendent's conditions of employment including hours per week, vacation period, and evening activities; (7) the superintendent's attitude toward the problems and pressures of the position; and (8) the acceptance of democratic practices in school administration.

The following conclusions from the study are indicated:

1. A negligible relationship exists between the age of the superintendent and the school enrollment.
2. A significant relationship exists between the length of service of the superintendent and the school enrollment.
3. The professional preparation of the superintendent increases as the school enrollment increases.
4. The school enrollment is an important factor in determining the percentage and total amount of time devoted to major duties, and divisions of the school.
5. The superintendent desires to spend a greater percentage of his time in matters devoted to the improvement of instruction.
6. The evidence indicates that a greater percentage of the superintendents in Missouri have occupied positions in the high school than in any other division of the educational system.

7. The superintendent is dissatisfied with the graduate training program, and desires a minimum two year requirement for certification. The contemplated program would give increased emphasis to the study of sociology, anthropology, and human relations.

8. Authorities in the field indicate the changing concept of the superintendent's position, and stress the need for a revision of the graduate program based on the complex nature of modern society.

9. Superintendents are utilizing democratic practices in school administration, but opinions vary as to the desirable extent of such practices.

129 pages. $2.00. Mic 57-1263

THE DUTIES AND CONTRIBUTIONS OF THE ELEMENTARY SCHOOL SECRETARY

(Publication No. 19,981)

Chauncey F. Benton, Ed.D.
New York University, 1956

Chairman: Professor Frithiof C. Borgeson

The Problem and Its Setting

The purpose of this investigation was to study the duties and contributions of the secretary to the school program in selected elementary schools in New York State and to recommend appropriate policies for the delineation of the respective duties of the elementary school secretary and principal.

The principal in the modern elementary school is faced with the problem of finding time to asseverate adequate professional leadership in improving the school's instructional program to meet the needs of children in today's society. He has come to rely more and more upon his secretarial assistant for the accomplishment of office routines and clerical duties, so that he might give maximum attention to his pressing professional responsibilities.

Knowledge of the duties found to be significant for the individual performance by the elementary school secretary can be useful to principals in determining which duties should be retained for performance by them personally and which duties may be delegated to the secretary. This study brings to light specific duties which may be delegated to a competent elementary school secretary.

Sources of Data and Procedure

The method of research used in this study was of the questionnaire-survey type.

Questionnaire check-lists enumerating 135 non-professional duties apposite to an elementary school were sent to 329 elementary schools located in the village and city superintendencies of New York State, excluding Buffalo and New York City. Ninety per cent or 295 of the principals of these schools submitted data disclosing which of the following personnel usually perform a given duty in the schools surveyed: the secretary, the principal or other personnel.

All data received were separated and tabulated according to school size. Schools with pupil enrollments of over 400 and those with pupil enrollments of under 400 were analyzed separately. This procedure made it possible to indicate the variance of secretarial duties in large and small schools.

The chi-square test, an appropriate method of evaluating experimentally determined results against results to be expected on some hypothesis, was chosen to treat the obtained data. The hypothesis used was that of equal probability. Chi-square values were used to determine which duties are statistically significant for the individual performance by the secretary, principal, or other personnel. The obtained chi-square values were interpreted in Fisher's Table of Significance.

Duties were then ranked according to the relative values of chi-square as obtained for each response to a question.

Certain duties surveyed, which were not found to be statistically significant for the individual performance by the secretary, principal, or other personnel were submitted to a panel of experts who judged which of these duties might be delegated to a competent secretary.

Recommendations for the delineation of the respective duties of the elementary school secretary and principal were validated by chi-square tests and by the consensus of the experts.

Findings

There were found to be a total of 68 individual duties in nine classifications which were found to be statistically significant for the individual performance by the secretary in the large elementary school. Sixty-three specific duties in all nine classifications, except duties relating to the handling of audio-visual aids, were found to be statistically significant for the individual performance by the secretary in the small elementary school.

The principal of the large elementary school performs to a statistically significant degree a total of 28 specific duties surveyed, while the principal of the small school was found to perform only 25 such duties to a statistically significant degree.

In the large elementary school there were found to be only nine specific duties which were not statistically significant for the individual performance by the secretary, principal, or other personnel; while 24 such duties were discovered in the small school. The experts agreed that two of the nine and eight of the 24 aforementioned duties should be delegated to a competent secretary.

Conclusions

There is a total of 76 specific duties apposite to an elementary school which may be delegated to a person with secretarial training and which do not call upon the professional training of the principal or classroom teacher.

There are 28 of the specific duties investigated which should be retained for the individual performance by the principal, since they do call upon his professional training in varying degrees.

In the large elementary school, the division of the respective duties of the secretary and principal is more sharply defined than in the small school.

An elementary school with a pupil enrollment of 348.0 and over requires the services of at least one full-time secretary, five days per week; while a school with over 567.0 pupils requires the services of more than one full-time secretary, five days per week.

Recommendations

The tabular presentations of specific duties shown in the study which were found to be significant for the individual performance by the secretary, principal or other personnel, are recommended for use as a guide in delineating the respective duties of the secretary and principal.

The rank order of the duties may be used in deciding which duties should be delegated to the secretary according to the amount of services provided, and which duties should be retained for performance by the principal personally.

203 pages. $2.65. Mic 57-1264

NEBRASKA STATE-WIDE PLAN FOR DETERMINATION OF SCHOOL PLANT NEEDS

(Publication No. 17,585)

Donald Oren Bush, Ed.D.
The University of Nebraska Teachers College, 1956

Adviser: Merle A. Stoneman

The purpose and Procedure of the Study

The purpose of the study was to determine the feasibility of providing a state-wide plan of school district organization, administration, and financial support for the construction and operation of the educational facilities which would provide an equal educational opportunity for each Nebraska child. The procedure followed in the study involved:

(1) A review of the significant political, sociological, geographical, technological and economic factors which in the past and at the present time exert an influence on the development of Nebraska's educational system.

(2) An inventory of the existing Nebraska school facilities and curricular programs together with a survey of Nebraska's financial resources available for the support of education in each district.

(3) An inventory, based upon a pupil population study, of the existing school facilities and a projection of these needs to 1960.

(4) An evaluation of the present status of school district reorganization in Nebraska. This included a study of selected Nebraska counties in order to determine the feasibility of a more comprehensive scale of reorganization which would provide the necessary potential for equal educational opportunity.

Results of the Study

The study revealed that a great many inconsistencies have existed throughout the development of the Nebraska public school system, particularly in the areas of the school program, the financial support, and the legal control of education. This is felt to be primarily a result of the dual administrative legislation which permits a K-8, or a K-12 organization.

Although the title of this study emphasizes a state-wide plan for the determination of school plant needs, it was recognized at the outset that a satisfactory form for the reorganization of school districts would be a major consideration. This study definitely shows the limitations of the present Nebraska school district organization in providing adequate facilities or in supporting a satisfactory state-wide educational program.

It is the opinion of this writer that the number one educational problem in Nebraska lies in the public recognition of an equal educational opportunity for each child in the state. The profession of education has the responsibility of molding a favorable public opinion which will ultimately achieve the goal of providing each child educational experiences which offer to him the maximum opportunity to develop as a useful, productive citizen in a free democratic society. The solution to this problem rests with the profession.

These additional conclusions are substantiated by this study:

1. The provision for adequate state-wide school facilities is dependent upon the organization of effective school districts.
2. A piecemeal plan of reorganization, such as that developed in some areas, has not provided the necessary potential for an effective school system. This is particularly true with respect to adequate school facilities.
3. The county reorganization committees could initiate and carry out an effective state-wide plan or reorganization if the state committee was granted authority of approval.
4. Certain areas of Nebraska will require more arbitrary authority to bring about satisfactory reorganization either in the form of a legislative deadline or through financial incentive.
5. Although this study indicates that the State of Nebraska does have sufficient taxable wealth to support adequate school facilities as a whole, there will be certain areas which cannot support school facilities and equal educational opportunity on an enlarged local K-12 district plan.

Recommendations

1. Encourage legislative action to give the state reorganization committee authority for approval of all school district reorganization proposals and to establish the latest date for reorganization.
2. Provide the State Board of Education with authority to prepare a state plan of school district organization which facilitates equal educational opportunity in the state.
3. Provide sufficient personnel in the Department of Education to give the necessary leadership and field service to implement the movement.
4. Continue the advisory school building services of the State Department of Education as a means of determining needed new school facilities and improvements.

282 pages. $3.65. Mic 57-1265

A STUDY OF SCHOOL BOARD DUTIES AND RESPONSIBILITIES IN THE STATE OF WASHINGTON

(Publication No. 20,475)

Victor R. Cullens, Ed.D.
State College of Washington, 1956

The purpose of this study was threefold:

1. To set up important areas of school board action
2. To determine duties and responsibilities of school boards and school board members in each of these areas
3. To develop a handbook for school board members in Washington which would incorporate the findings of the study.

The initial step in the project was to select members for a State Central Handbook Committee. This was done through the joint efforts of the co-directors of the Project: Elmer W. Stanley, Executive-Secretary of the Washington State School Directors' Association, and Zeno B. Katterle, Dean, School of Education, State College of Washington. The membership of the Committee consisted of five school directors, one superintendent of schools, one secondary school principal, one elementary school principal, one classroom teacher, one member of the State Board of Education and one representative of the State Department of Education. The writer served as ex-officio secretary to the group.

At the first meeting of the Central Committee the general areas of school board action were tentatively formulated and designated as chapter headings for the projected handbook. These were as follows:

1. The School Board (including legal basis, major functions, etc.)
2. The School Board Member as an Individual
3. Organization and Meetings of the School Board
4. School Board--Superintendent Relationships
5. Personnel Functions of the School Board
6. School Board--Community and other General Relationships.
7. The School Board and the Educational Program
8. The School Board and School Financing
9. The School Board and the School's Physical Facilities.

These major headings were developed into a rating scale which was submitted to the Central Committee and, as a result, was refined into an instrument which was used to sample the opinion of the following groups regarding the handbook content.

1. All of the superintendents of schools in Washington (of the 228 mailed out, 181 or 79.4 per cent were completed and returned).
2. All of the county superintendents of schools in Washington (thirty-three or 84.6 per cent of the thirty-nine were returned).
3. The rating scales were distributed to 714 school directors at eight regional meetings of the Association and 343 or 48 per cent were either filled in during the discussion periods or filled in later and mailed to the writer.

When the results of this sampling of opinion were tabulated, it was decided to include all of the 103 items of subject matter included on the rating scale in the Handbook for Washington School Directors.

The data for the study were collected from the following sources:

1. A survey of handbooks, guides, and manuals published by state school board associations and state departments of education.
2. A review of the literature in the fields of general school administration, school finance, school buildings, and school board activity.
3. Information furnished by the Central Handbook Committee, school board members, and school administrators.
4. Information furnished by the Washington State Department of Education, State Board of Education, and State School Directors' Association.
5. Session Laws of the State of Washington and rulings of the Washington Attorney General.

The study was primarily concerned with the duties, responsibilities, and recommended procedures within the areas of school board action as defined by the Central Handbook Committee, school board members, county superintendents of schools, and local or city superintendents of schools.

No attempt was made to set up specific policy or procedure for any individual district or class of districts. Neither was there an attempt to evaluate present practices of any given school board or group of school boards in terms of recommended policies and procedures.

365 pages. $4.70. Mic 57-1266

TRENDS IN ASSESSED VALUATIONS IN THE COLUMBIA BASIN PROJECT AREA, AND THEIR EFFECT ON SCHOOL FINANCE

(Publication No. 20,477)

Russell M. Esvelt, Ed.D.
State College of Washington, 1956

The school districts of the Columbia Basin Project area in the state of Washington are experiencing unusual increases in enrolment as a result of reclamation development. In 1951, prior to first water delivery, school enrolments in the affected area totalled 6,501; the estimated enrolment in 1963 is 22,000, representing an increase of 238 per cent.

School districts in Washington derive about 25 per cent of their operating revenues, and half of the funds needed for capital outlay, from the local property tax. Since property tax levies are severely restricted by law, local assessed valuations determine to a large extent the amount of revenue available to the schools from local sources. Whether or not Columbia Basin school districts can provide their share of funds for expanding school needs depends upon the extent to which assessed valuations are increasing in comparison with growing school enrolments. Comprehensive planning demands that potential revenues be determined with some degree of accuracy.

This study has measured the effect of irrigation upon the assessed valuation of farm units in the Project area. Starting in 1952, 373 units experienced continuous irrigated operation during the 1952-54 period. According to tax rolls, the assessed valuation of land, improvements, and personal property among these units averaged $1,234 in 1952, based upon 1951 dry-land appraisals. A year later the average assessed valuation increased to $3,032, and in 1954 it reached $3,702. Of significance was the uniformity of assessed valuations among the irrigation blocks;

among the five major blocks surveyed, the range of average assessed valuations was from $3,580 in Block 72 to $3,930 in Block 40. Seventy-seven units which had been in operation five years or more on a pilot project revealed an average assessed valuation of $4,553; the higher figure was due entirely to increases in the value of personal property following the second year.

Previous studies have estimated that each farm unit developed will add .86 farm pupil to the local district's school enrolment. At maturity, therefore, the farm property will account for about $5,200 per pupil in assessed valuation, very close to the state average.

Urban development related to the reclamation project is resulting in further increases in the area's population and school enrolments. Of importance to the school districts is whether assessed valuations are increasing in proportion to population growth. Among five representative towns of the Project area, the per capita assessed valuation has actually increased during the period from 1950 to 1955. Recognizing the fact that assessed valuations lag one year behind property improvements, the assessed valuation increase during the four-year period 1951-55 was compared with the population increase during 1950-54. In the five towns studied, for each person added to the population the assessed valuation increased $1,472; this figure is well above the assessed valuations per capita existing in 1950, which ranged from a low of $356 in Ephrata to a high of $762 in Quincy.

The following conclusions are supported by the study:

1. When fully developed, the irrigated farm property will provide assessed valuations for local school support comparable to state averages.

2. Increases in assessed valuation lag behind farm development; during the second year of development a substantial increase has taken place, but not until the fourth or fifth year does the assessed valuation of farm property reach its mature level.

3. Assessments of farm units are sufficiently uniform and consistent to permit reasonably accurate predictions of assessed valuations.

4. Non-farm activities in the Project area are resulting in assessed valuation increases which will provide a per capita tax base in the towns greater than that existing prior to reclamation development.

133 pages. $2.00. Mic 57-1267

THE ROLE OF CALIFORNIA TEACHERS IN TEACHER SALARY ADJUSTMENT

(Publication No. 20,433)

Ruby Alta Ferguson, Ed.D.
Stanford University, 1957

The problem.-- The purpose of the study was to determine acceptable standards, as derived from the experiences of California teachers, for effective participation of teachers in salary adjustment. As criteria based on well-founded principles of school organization and democratic procedure, these areas of committee action were investigated: (a) district influences affecting participation, (b) committee preparation, (c) committee concern with professional improvement, (d) teacher responsibility, (e) relationships within the district, (f) use of services and materials of state teacher organizations. Data relating to these criteria were developed in corresponding chapters of the dissertation.

Procedure.-- The investigation required preparing and administering a comprehensive check list. Selection of the sampling (158 salary committees) was accomplished by contacting salary experienced teachers named by presidents of local organizations. Local presidents were approached through listings provided by the C.T.A. and C.S.F. of T.

Information regarding salary committee activities of 1950-1951 supplied the basic material of the study.

The data represented salary interests of 57 per cent of California teachers in 8 per cent of districts geographically representative of the populated portions of the state. Large district replies exceeded those of small districts (under 850 A.D.A.) by proportions of three to two.

Results.-- Three-fourths of the salary committees studied district and C.T.A. materials, maintained two way channels with teachers, fostered cooperative relationships with administrators and school boards, jointly formulated salary policies. Most committees favored in-service growth provisos in the schedule and directed their teachers in community relations.

When income was short, most committees wanted to restudy the budget and to retain items contributing to better learning experiences. More than one-third noted teacher welfare items as those most willingly discarded.

Teacher competence in participation was most evident in combined districts; least noted in small districts. Independent teacher action, feelings of resentment and misgiving were most noted in high school negotiations.

Conclusions and recommendations.-- Concern for preserving a quality educational program, even at the cost of welfare benefits, marks teachers as responsible partners in the planning of salary policies. C.T.A. services to local committees help to reduce tensions and strengthen the position of teachers as professional participants.

The outlook for success appears most promising when the salary request is objective, reasonable, and cooperatively planned; presented in a friendly way by a united and informed teacher group; and when the board has had prior opportunity to examine the proposal. Most damage is done to teachers' interests when teachers use threats or pressure tactics to gain their salary ends.

Recommended as important standards for effective teacher participation are the following practices:

1. Selection of representative, fair minded, and competent committee personnel.
2. Inclusion of the administrator in cooperative planning.
3. Formulation of a well balanced salary request based on professional need and district ability to finance.
4. Presentation of graphic, accurate, and convincing information.
5. Respect for persons and viewpoints throughout salary deliberations.
6. Use, in those few situations where cooperative planning is denied to teachers, of professional aid available through C.T.A. Field Service.

Joint support, by the C.T.A. and the California School

Boards' Association, urging use of the single salary principle in schedules of all California districts is recommended.

To strengthen rural teachers participation, use of the offices of county superintendents as centers for continuous study of salaries and salary related problems by cooperative area committees is suggested.

The following are recommended as problems for further research:

1. The administrative responsibility in salary adjustment.
2. The effect on district relationships of including a school board member on the teachers' salary committee.
3. Effective administrator-board practices for dealing with the situation when an association and a union compete for recognition as teacher salary representative.

624 pages. $7.90. Mic 57-1268

AN ANALYSIS OF ADMINISTRATIVE PRACTICES OF LARGE SIX-YEAR HIGH SCHOOLS OF THE NORTH CENTRAL ASSOCIATION OF COLLEGES AND SECONDARY SCHOOLS

(Publication No. 20,568)

Charles E. Grady, Jr., Ed.D.
The University of Oklahoma, 1957

Major Professor: Dr. Glenn R. Snider

The purpose of this study was to discover and analyze various administrative practices that were being used in the large six-year high schools of the North Central area, with enrollments of 1,000 or over. This limitation was established as this area was large enough to warrant the study yet small enough to make feasible the utilization of the total population. No attempt was made to collect information on all possible practices, but an effort was made to include the major phases of school administration and at the same time keep the questionnaire to reasonable length. Many of the questions contained in the questionnaire were derived from suggestions received from the principals who have had a part in the six-year high schools sectional meetings at the National Association of Secondary-School Principals from 1952-1956. Eighty schools from fourteen states were included in the study. These schools represented an 80 per cent return on the questionnaire.

The following conclusions were made:

1. The administrative heads of the school appeared to possess minimum qualifications for their positions in terms of professional preparation. Many possessed secondary administrative experience prior to their present positions, 90 per cent were over forty years of age, and 62.5 per cent had been in their present positions for more than five years.
2. The position of the principal had assumed professional status in that he was given a great deal of freedom in the selection and retention of faculty members assigned to his building.
3. The administration of the large schools was too big a job for one man which made it necessary to have a second administrator, usually referred to as an assistant principal.
4. The principal tended to assume responsibility for curriculum improvement, the assignment of teachers, making the class schedule, and the supervision of the custodial staff.
5. The assistant principal was usually responsible for attendance supervision and discipline problems.
6. The provisions made for counseling in over one-third of the schools studied were weak since the counselor-student ratio in these schools ranged from 1-500 to 1-1,000 or more.
7. In 45 per cent of the schools all teachers were assigned activities to sponsor, 40 per cent paid teachers an additional salary for this added responsibility, while many schools reduced the teaching load to compensate for this additional task.
8. Evidence that the schools were single unit six-year high schools was provided by single administration, use of building, and elimination of promotion and graduation exercises for lower grades.
9. There was some indication, however, that the schools were being administered as both junior and senior high schools. This was noticeable in accrediting rules and regulations, enrollment procedure, activity participation, and the assignment of teachers.

166 pages. $2.20. Mic 57-1269

THE AVAILABILITY AND NEED OF EDUCATIONAL SERVICES IN WISCONSIN PUBLIC SCHOOLS IN RELATION TO THE FUNCTION OF THE INTERMEDIATE UNIT OF EDUCATIONAL ADMINISTRATION

(Publication No. 20,626)

Howard William Heding, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Russell T. Gregg

Concern for the future status and function of the county intermediate unit of educational administration in Wisconsin raised the question: What agencies should be the future providers of educational services to the public schools? A study was instigated to determine the need for educational services in public schools and to ascertain whether the intermediate unit of educational administration should participate in the provision of these services.

Opinion data was collected, by means of questionnaires, concerning the importance, availability, and quality of ten areas of educational services and the agencies which are now, and should be, the providers and administrative agencies for these services. The opinion responses of large numbers of local school administrators, county superintendents, members of the State Department of Public Instruction, and members of selected lay citizens groups were analyzed, employing non-parametric statistical techniques, to determine the extent of agreement among the

various groups on the questions posed. The combined opinion of all groups was interpreted with respect to the need for educational services and the agencies which should provide and administer them. The areas of educational services were pupil personnel, instructional and curriculum, health, specialized education, general administration, business and finance, staff personnel, research and statistical, adult education, and public relations and liaison services.

Although all educational services were believed to be of great or very great importance, services related to pupils and instruction were accorded greater importance in a modern educational program than were services related to administration, adult education, and public relations. Each area of educational services is available to only a moderate or slight extent and in average quality to majorities of elementary, kindergarten or 1-12 grade, and union high school districts. Large elementary, large K or 1-12, and city school districts have educational services available to a greater extent and in better quality than do the smaller school districts of each type. Educational services of a technical or specialized character were the least available to local districts. The local school district is presently the primary provider of each area of educational services. The county intermediate unit is the secondary source of each type of educational service to a majority of the elementary districts and many small K or 1-12 and union high school districts. The State Department of Public Instruction is the secondary source of the various services to a majority of the large K or 1-12, union high, and city school districts.

The opinion evidence revealed that the local school district should be the future primary provider of all types of educational services. It was also evident that the intermediate unit of educational administration and the State Department of Public Instruction should participate in the provision of all areas of services to all types of local school districts. The local school district, the intermediate unit of educational administration and the State Department of Public Instruction should each have a role in the administration of educational services.

It was concluded that there is a great need for improved availability and quality of educational services in the public schools of Wisconsin. The need is greatest in elementary, kindergarten or 1-12 grade, and union high school districts. Especially needed are educational services of a technical or specialized nature. Local school districts, the county intermediate unit, and the State Department of Public Instruction are apparently unable at the present time to provide these services in the quantity and quality needed. The local school district should be the future primary provider of all except the most highly specialized educational services. However, pending the organization of more adequate local districts, the intermediate unit should be an important source of these services. The services of the intermediate unit of educational administration should be expanded to include the technical and specialized services needed in local school districts. The State Department of Public Instruction should also participate in the provision of educational services, especially to the larger city school districts.

490 pages. $6.25. Mic 57-1270

CHARACTERISTICS OF WOMEN TEACHERS OF EDUCATION IN INSTITUTIONS OF HIGHER LEARNING IN THE UNITED STATES OF AMERICA

(Publication No. 20,754)

Jacqueline Quigley Karch, Ed.D.
Washington University, 1956

Chairman: Dr. Adolph Unruh

The study was undertaken in an effort to determine what factors of (1) personal background, (2) preparation and experience, and (3) present position of employment were characteristic of women who taught professional education courses in institutions of higher learning. A secondary objective of this research was to examine the hypothesis that existing institutional policies have hindered women's opportunities for promotion.

Names of 194 state supported and private, nondenominational institutions of higher learning were selected from the College Blue Book and the Education Directory -- 1953-54, Part 3 - Higher Education. Catalogues from these 194 institutions were surveyed to select women who would be canvassed for participation in the study. Requests for names of women faculty in education were sent to an administrator at each institution. Thirteen-hundred eight names were obtained by these two methods. Questionnaires were sent to these 1308 women; findings were based on 860 responses (65.7 per cent).

The data of the study were derived from a three-section questionnaire. Section One of the questionnaire contained questions on family background, vital statistics, marital status, vocational choice, and leisure-time interests; Section Two pertained to sources of formal schooling, teaching experience, and other types of employment; the final section had questions on institution where employed, nature of assignment and job satisfaction.

Major findings testing the hypotheses and within the limitations of the study were as follows:

1. Personal Background of Women Teachers of Professional Education:
   a. They were frequently reared in farm homes.
   b. They regarded themselves as principally from homes of the "middle" to "upper-middle" groups.
   c. They were frequently from families of three or more children, but they had no special position of birth with relation to siblings.
   d. The median formal schooling of their parents exceeded that of people of comparable age.
   e. They were quite generally within the ages of forty-five to fifty-five years.
   f. They were of single marital status in a greater ratio than was true for women workers in general.
   g. Some have helped with the support of dependents, but the relative per cent was lower than for women workers in general.
2. Preparation and Experience of Women Teachers of Professional Education:
   a. Their early schooling was generally received from public elementary and public secondary schools.

b. Their first degrees were generally from public teachers colleges.

c. Their highest graduate degrees were granted to approximately the same extent by private universities and state universities.

d. Two-thirds of the women had not completed doctoral study; this probably had hindered their opportunities for promotion.

e. Teaching experience at either the elementary or secondary level, or both, was characteristic.

f. Their professional work had been mainly centered on the preparation of prospective elementary teachers.

3. Present Position of Women Teachers of Professional Education:
   a. They frequently were assistant professors.

   b. They were more often employed on a full-time than a part-time basis.

   c. Their greatest opportunities for employment were at public teachers colleges.

   d. They were frequently employed in states away from their childhood home.

   e. The institutions where the majority were employed had more than one-third of their faculty positions in education filled by women.

   f. They have expressed satisfaction with present positions; as a group, these women seem to desire to stay in their present positions.

Data of the study revealed that there was disagreement on just what were actual and theoretical promotion policies. Findings on reactions to policies were not consistent, and the hypothesis that women's professional opportunities have been hindered by institutional policies could be neither substantiated nor disproved.

267 pages. $3.45. Mic 57-1271

ATTITUDES AND BEHAVIORS OF GROUPS OF SCHOOL ADMINISTRATORS

(Publication No. 18,415)

Carl John Kleyensteuber, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor Glen Eye

The purpose of this study was to determine whether groups of administrators with different backgrounds have patterns of attitudes and behaviors which differentiate the groups from each other and from corresponding groups of teachers.

The persons studied in this investigation were one hundred twenty-six male administrators and one hundred twenty-six male teachers selected randomly from ninety-six public high schools in Wisconsin, and sixty-one male education students from eight institutions of higher learning in the same state.

Attitudes were identified through the interview method of investigation by obtaining scores for each individual on the six categories of the Allport, Vernon, and Lindzey Study of Values, namely, the theoretical, the economic, the aesthetic, the social, the political, and the religious. Behaviors were determined from scores for each individual in the same six categories of the Practices and Procedures Inventory for Educators. Group attitudes and behaviors were identified for each category by obtaining the mean scores for the individuals comprising groups based successively upon Wisconsin geographical location of school served, enrollment of school served, age, experience, undergraduate college, education credits earned, science teaching experience, social studies teaching experience, and military service. Differences in means, relatively high and low means, attitude-behavior correlations, and attitude and behavior profiles were examined for the groups under consideration.

In the attitudinal and behavioral categories, similarities were more numerous than differences between groups of administrators with different backgrounds and between the groups of administrators and corresponding groups of teachers. Insofar as a difference in at least one attitude or behavior category was indicative of differentiation, groups were considered differentiated by differences in means at the .01 to .05 levels of significance and as having shown trends at the .06 to .20 levels.

Groups of administrators with different backgrounds of Wisconsin State College undergraduate preparation, education credits earned, science teaching experience, social studies experience, and military service have patterns of attitudes and behaviors which differentiate the groups.

Groups of administrators with different backgrounds of enrollment of school served have patterns of behaviors which differentiate the groups.

Groups of administrators with backgrounds of northern Wisconsin and southern Wisconsin location of employment, age over thirty-five years, experience over five years, other than Wisconsin State College undergraduate preparation, less than forty education credits, science teaching experience, no science teaching experience, and no social studies teaching experience have patterns of attitudes and behaviors which differentiate them from corresponding groups of teachers.

Groups of administrators with backgrounds of three hundred students or less and over three hundred, respectively, in school served, age thirty-five years or less, five years experience or less, Wisconsin State College undergraduate preparation, forty or more education credits, social studies teaching experience, and military service have patterns of behaviors which differentiate them from corresponding groups of teachers.

Groups of administrators with different backgrounds of Wisconsin geographic location of school served, enrollment of school served, age, and experience show trends toward having patterns of attitudes which differentiate the groups.

Groups of administrators with different backgrounds of Wisconsin geographical location of school served and experience show a trend toward having patterns of behaviors which differentiate the groups.

Groups of administrators with backgrounds of enrollment of three hundred or less and over three hundred, respectively, in school where employed, age thirty-five years

or less, Wisconsin State College undergraduate preparation, forty or more education credits earned, social studies teaching experience, and military service show trends toward having patterns of attitudes which differentiate them from corresponding groups of teachers.

The three most frequently appearing factors of differentiation were social attitude, social behavior, and political behavior. 451 pages. $5.75. Mic 57-1272

RELATING GUIDANCE PHILOSOPHY TO FUNCTION: A STUDY OF THE LOCATION OF GUIDANCE FACILITIES WITHIN THE SCHOOL PLANT

(Publication No. 20,214)

Kenneth H. Parker, Ed.D.
Michigan State University, 1956

This study attempts to compare the attitudes of high school principals, counselors, and professional counselor-trainers and state guidance supervisors toward the location of guidance facilities within the school plant and especially the relationship of the guidance area to the main administrative office.

This was done by using mailed material which included (1) a set of six plans, showing six possible locations for the guidance area in relation to the principal's office, (2) a personal data sheet, (3) a rating sheet, and (4) a questionnaire. Each respondent was asked to rank the plans from one to six, in order of his preference.

Two philosophies of guidance were established, labeled "authoritative, directive" and "permissive, non-directive". The questionnaire was used to determine which of these two philosophies each respondent held. The study shows that there is a definite relationship between the philosophy held and the type of plan preferred.

The plans were dichotomized into two groups, of three each, which seemed to fit the two philosophies. Two statistical tests, a Critical Ratio and a Chi Square, were used to validate the two philosophies (as measured by the questionnaire) against the dichotomized plan groups. Both tests were significant and justified labeling one set of plans "permissive" and the other set "authoritative". In the three "permissive" plans, the guidance offices are widely separated from the main office, while in the "authoritative" plans, the guidance suite is within, or adjacent to, the main office. Counselors and counselor-trainers are more likely to prefer the plans related to the "permissive" philosophy while principals are more likely to prefer plans related to the "authoritative" philosophy.

Younger persons, those who received their latest degree since 1945, those with more training in guidance, those with experience in guidance, and those with experience in planning a guidance area, all tend to prefer the "permissive" plans more often than the other respondents.

Three-fourths of both the principals and counselors reported dissatisfaction with their present physical facilities for guidance.

The results indicate that principals and counselors have different preferences for the location of the guidance offices, that neither are satisfied with their present plans, and thus careful, cooperative planning is necessary before locating the guidance area in new secondary school buildings. 174 pages. $2.30. Mic 57-1273

AN INQUIRY AND INTERPRETATION OF CERTAIN BASIC ASSUMPTIONS OF EDUCATIONAL ADMINISTRATION

(Publication No. 17,578)

Frank Robert Paulsen, Ed.D.
University of Utah, 1956

Chairman: Paul C. Fawley

The study was an outgrowth of a former research interest analyzing the theory of administration per se. It became apparent that educational administration lacked a definitive theory insofar as the administrative component was concerned. Education, as a profession, and as a concept of growth, appeared equated to a concept of democracy. Educational administration appeared weak in the formulation of principles of organization and procedure consistent with democratic dogma and administrative know-how. Assumptions of educational administration were implied, but not always stated.

STATEMENT OF THE PROBLEM

The dissertation purported, therefore, an inquiry and interpretation of some of the basic assumptions of educational administration. Administration, as a general field of social and governmental operation, was analyzed. Educational administration, as a specific activity, was analyzed. Certain basic assumptions of educational administration were formulated and interpreted. The study showed that administration is a most significant and highly developed art in the field of social action, and that it is responsible, in large part, for the survival of the modern democratic state.

The specific objectives of this study were:

1. To review the general concepts and elements of public administration.
2. To search literature and research studies for statements and/or ideas implying basic assumptions of educational administration.
3. To obtain suggestions from "experts" in the field of educational administration relative to probable assumptions of this activity.
4. To formulate and submit a list of basic assumptions to an expert jury for evaluation, five-hundred members of the American Association of School Administrators. These statements were overwhelmingly accepted as basic assumptions of educational administration.

The basic assumptions, about which this study was primarily concerned, and which were formulated through research, and accepted by the twelve man expert jury and four hundred and forty-two practicing educational administrators were:

1. Educational administration cannot be dissociated from philosophy.
2. Training for educational administration should include a professional program and actual experience in the field.
3. The position of education in the social structure of the American nation is unique, and may be above and beyond the general concept of positive law.
4. The control of education should be vested in specific educational policy-forming boards, and this control should not be a consideration of partisan politics nor directly related to the administration of other state agencies.

5. Although administrative activity may operate by authority rather than by concensus, administration, generally need not be contrary to democratic processes and objectives of American education.

6. Public education is a basic and permanent part of the continued existence of our form of government and the freedom it guarantees.

7. Educational administration is ultimately responsible for executing the educational policies of a school district.

8. Educational administration must provide educational leadership and stimulation.

9. Educational administration must seek a balance between politics and the profession.

10. Educational administration in the twentieth century must recognize the renaissance of the lay citizen.

423 pages. $5.40. Mic 57-1274

THE ROLE OF TEACHER COUNCILS IN PROMOTING DEMOCRATIC ADMINISTRATION IN NEW YORK CITY PUBLIC SCHOOLS: An Appraisal of the Effectiveness of Teacher Councils in Promoting Democratic Staff Participation in the Administration of Their Schools, With Proposals for Increasing Their Effectiveness

(Publication No. 17,669)

Julius Ralph Rubin, Ed.D.
New York University, 1956

The Problem

A pressing problem in education today is that of democratizing school administration by permitting teachers to participate in the running of schools. Despite the widespread support given to the principles of democratic school administration, the implementation of teacher participation lags far behind expectations.

The purpose of this study was to examine the extent and the effectiveness of teacher participation, through teacher councils, in the administration of selected schools in New York City, where the Board of Education has made signal progress in this area, in order to develop recommendations for increasing the effectiveness of such participation.

For this study the investigator submitted to 300 teachers and school supervisors in approximately 75 schools of New York City, a questionnaire appraising the extent and the quality of teacher participation in 29 comprehensive school areas within the administration of the respondents' own schools. This procedure was followed by interviews with school personnel, observations of teacher council meetings in action, examination of council records and a survey of pertinent literature. The survey was concerned too with ascertaining those factors which help programs of teacher participation succeed.

The Findings

This investigation indicates that teachers and supervisors responding are in close agreement on most points involving democratic school administration. Teachers do participate to some degree in most school administrative areas in New York City schools but such participation has extreme variations from school to school, centering mainly in areas of curricular adaptations, teacher welfare matters and pupil personnel procedures, and least in supervisory policies, parent-community relations and school evaluation. Teachers and supervisors agree that the gap which exists between the kind and quality of teacher participation which they feel to be desirable and feasible, and the actual state of current participation, is significantly wide. They feel that in most administrative areas teachers should have the basic right to be consulted on policy, and to render judgments, which will be given real consideration.

Success in developing or improving programs of democratic school administration is due to a combination of specific factors. Among those felt to be important are, responsible teacher leadership, adequate time for participation, clearly delimited areas for teacher participation, impartial handling of grievances, recognition for good work and the enthusiasm for participation on the part of the principal and teachers. Failure to promote democratic administration may be measured by the relative lack of these and other positive factors in any school situation.

A major limitation to teacher participation appears to be the absence of legal authority for teachers to share in decision-making rather than be merely advisory.

While many techniques are employed in schools to implement teacher participation, an efficient, democratic teacher council is considered a most promising, comprehensive procedure to vitalize this program. Such councils exist in perhaps a majority of New York City schools, but their status, organization and functions are loosely defined.

The Recommendations

Revitalized teacher participation in the administration of New York City schools may better be advanced through the implementation of a broad plan to utilize the potential capabilities of the teacher council idea. This plan may include: authorizing teacher councils through by-law; authorizing teacher participation in certain delimited administrative areas; creating a central teacher council service agency; and clarifying the principal's responsibility in promoting active teacher councils. Schools may appraise the extent of teacher participation by using prepared checklists of Areas for Democratic Teacher Participation, as well as by diagnosing through a checklist particular problems confronting the development of this program in their situations. The improvement of teacher council functioning is recommended through a plan for the constitutional organization of teacher councils, for the administration of a school activity by a teacher council and for the evaluation of teacher council meetings in action. A plan for personnel training in democratic school techniques is offered. 313 pages. $4.05. Mic 57-1275

AN INVESTIGATION INTO THE PROCESSES USED BY AN ELEMENTARY PRINCIPAL AS HE HELPED HIS TEACHERS TO IDENTIFY CHILDREN WITH PROBLEMS AND TO WORK CONSTRUCTIVELY WITH THEM

(Publication No. 20,847)

Fred Boyd Squires, Ed.D.
University of Utah, 1956

Chairman: Marie M. Hughes

STATEMENT OF THE PROBLEM

The investigation was made in the Nibley Park Elementary School in Salt Lake City. The study included 410 children in the first through the sixth grades. The age range was from six to twelve years. The building was new and above average for Salt Lake City. There were thirteen classrooms.

The major problem was an investigation into the processes used by an elementary principal as he helped his teachers to identify and apply corrective measures to the problems of the children.

The specific purposes were:

1. To identify the children in a six year school, who because of emotional difficulty, need special attention.
2. To discover and apply techniques of identification that can be used by the average trained faculty.
3. To differentiate between children with severe emotional problems needing the help of specialists and those whom teachers can help.
4. To explore the ways a public school can meet the needs of children with emotional problems.
5. To discover and utilize techniques of in-service training that will help the teachers understand the behavior of children.
6. To analyze teaching situations to see what things teachers are doing that might add to or mitigate a child's emotional difficulty.
7. To clarify the role of the elementary principal as he works with his teachers and pupils to improve the emotional atmosphere of the school; and, works to meet the individual needs of pupils.

The Procedural Guide Lines. Certain hypotheses and assumptions were set up as guide lines to the study.

THE PROCEDURES OF WORK IN IDENTIFYING CHILDREN

The instruments used to identify the problems of the children follow:

The Affectivity Interview Blank was given to 410 children in the first through the sixth grades.

The Classroom Social Distance Scale was used to gain insights into a child's social status in his peer group and to gain a social score for mathematical manipulation. The Reputation Scale was administered to gain an insight of the perception the children had of one another; also, to discover how the child perceived himself and the teacher perceived the children.

Rating Scales. The teacher's ranked the children in general happiness and in social status.

A SURVEY OF ROOMS

A survey of the classes was made to discover what existed in the physical arrangement of the rooms, the learning situations, and the teacher-pupil relations that might lower the conditions for mental health in the room.

THE METHODS OF CORRECTIVE WORK

The "child study" group was created to test the forces of group dynamics and to cause teacher change.

The corrective measures included increased small group activities and individual help for a child.

The principal adopted a new dynamic role.

MEASURES OF CHANGE

Questionnaire. Teachers were asked to respond to a questionnaire designed to determine the changes the teachers had made and the values they had found in the study.

Change on the affectivity was determined by reinterviewing a group of children with the low scores. A test of significance was made on the d difference of the two means.

A survey was made of thirty-four children with negative social scores (C-R scores) and their changes in social status determined.

THE SECOND OBSERVATION OF THE PRINCIPAL

What Was Done. The furniture was used profitably in a variety of flexible arrangements.

The teachers made use of a variety of sub-groupings within the classroom.

There was a decrease in the number of children sent to the office for disciplining.

The teachers did less nagging and scolding and tried to find a place for all children.

GENERAL FINDINGS

Interesting information was found related to the children identified with serious affectivity and rejection. Significant change of these children for the better resulted from the application of corrective measures.

The whole school seemed to improve with better human relations and freer communication.

Miscellaneous correlations indicated that possibly happy children learn more.

A study of the, "Children who wished that they did not have to attend school," pointed out areas where the school could help them.

The atomistic and judgmental basis of the private judgment of teachers on why children were happy or unhappy probably caused the low correlations between the teachers' rank of a child and the Affectivity Interview Score.

The teachers and principal found values in the study and looked at children differently than previously.

465 pages. $5.95. Mic 57-1276

A STUDY OF AN EXPERIMENT IN THE USE OF SCHOOL SUBSIDIES TO PROMOTE COMMUNITY RECREATION PROGRAMS IN THE STATE OF WASHINGTON

(Publication No. 20,401)

Warren Rawford Tappin, Jr., Ph.D.
University of Washington, 1956

Statement of the Problem

It was the purpose of this study to provide an appraisal of the sixty-six community recreation programs that had utilized financial aid granted to local school districts through the provision of House Bill 88, Chapter 247, Sections 3-10. It was hoped that from such an appraisal conclusions might be made which would aid in determining not only the effectiveness of the state aid program but also the desirability or necessity of its continuance in the future.

Methods of Procedure and Sources of Data

Data were obtained for the state aid period primarily through the historical method involving a documentary analysis of primary sources of information in the form of records and reports on file in the office of the Washington State Superintendent of Public Instruction. Data for the year 1953 were gathered mainly through the descriptive survey method employing the interview procedure.

Summary of Findings

Administrative authority. The local school district assumed a leadership position in the administration of community recreation programs throughout the state aid years. Its administrative leadership was particularly strong in the second and third class districts where, alone or in cooperation with other local agencies, it administered over eighty per cent of the programs in 1946 and in 1950. With the discontinuance of state aid in 1950, the school district greatly reduced its administrative responsibilities, and no other local agency was able to take over the leadership role.

Financial basis. The Washington State Grants-In-Aid Program was successful during the state aid years in priming the communities to expend a greater amount of financial effort in support of their programs. This "pump-priming" process carried over in the first class districts to the post state aid era. The second and third class districts were unable or unwilling to increase their financial efforts in order to compensate for the loss of state funds and expended slightly more than one-fourth the amount of money on their recreation programs in 1953 that they had spent in 1950.

Leadership personnel. Leadership standards of all districts were lowered during the state aid period, with standards of the first class districts being higher than those of the second and third class districts in both the years 1946 and 1950. In spite of a 42.98 per cent cut in the total personnel of the second and third class districts, their remaining leadership possessed higher qualifications than did that of the first class districts in 1953.

Facilities used. All agencies, with the exception of the Federal Government, provided more facilities in 1950 than they had supplied in 1946. In 1953 all agencies, with the exception of the county, provided fewer facilities than in 1950.

Program services. Progress was made during the state aid years in broadening the scope of activities offered in all districts. However, in 1953 more than four of every five communities of the second and third class districts either had no program or confined their services to one or two activities. Only one of the first class districts dropped its program, and seventeen continued their services with one or more activities.

Program participation. Although an increase in attendance of over 300,000 was registered between 1946 and 1950, the teen-age group and the girls would seem to have been neglected in the programs of all districts. In 1953 the first class districts were attracting a greater attendance, more females, and a wider age spread, while the second and third class districts were confining their services mainly to boys between nine and ten years of age.

189 pages. $2.50. Mic 57-1277

NATURALISTIC ROLE-PLAYING: A METHOD OF INTERVIEW TRAINING FOR STUDENT PERSONNEL ADMINISTRATORS

(Publication No. 20,429)

Herbert Van Schaack, Jr., Ph.D.
Cornell University, 1956

The purpose of this study was to develop a method of training student personnel administrators in the principles and practices of good interviewing. This method, "naturalistic role-playing," consists of a number of preconceived interview situations in which a student actor from outside the training class portrays the role of counselee, and a trainee plays the role of counselor. Each situation, of which six are described in the study, is so designed as to outline: for the members of the class--information about the school where the interview is taking place and the facts which a counselor would normally have in dealing with the forthcoming interview; and for the student actor--the information given the class, and the background information concerning the counselee and the circumstances which precipitated the interview. Through the use of these situations, the investigator was striving to create realistic, spontaneous role-playing scenes which would vividly illustrate interviewing principles and practices in action.

The major share of the study is concerned with the methodology used to derive the maximum benefits from naturalistic role-playing situations. To achieve this objective, the author describes in detail the sources and method of writing these situations; the selection and training of student actors; the orientation of a class to naturalistic role-playing; the actual role-playing interview; and the evaluation session which follows the role-playing.

The latter part of the study is concerned with an actual application of six naturalistic role-playing situations to a

class of male student personnel trainees. These trainees, all of whom had had some practical experiences in the field of student personnel administration, were graduate students at Cornell University majoring in Guidance and Student Personnel Administration. The trainees' reactions to the role-playing sessions were elicited by means of two questionnaires, one of which was given out at the end of each class period, and the other one given out at the conclusion of the series of sessions.

These questionnaires served a twofold purpose: to identify principles and practices which could be traced to the role-playing interview; and to afford a means by which the trainees could offer their opinions of naturalistic role-playing. These responses are faithfully recorded in the study, along with the author's own observations and conclusions.

In the final analysis of this study, the investigator draws together all the information gathered from questionnaire responses, informal talks with the trainees and a staff member who participated in the experimental sessions, and personal observations, in an attempt to make an overall evaluation of naturalistic role-playing in terms of the original purpose of the study. From the evidence, it appears as if it did meet the original purpose. That is, naturalistic role-playing: (1) compares most favorably with other methods of teaching interviewing and, indeed, offers more emotional involvement than lectures or discussions; (2) is extremely realistic; (3) enables students to gain actual interviewing experience; (4) stimulates students to empathize with the role-playing participants; (5) illustrates a great number of interviewing principles and practices that are identifiable to the students; (6) demonstrates the varied approaches a counselor can take in an interview; (7) motivates group discussion; and (8) makes interviewing principles and practices meaningful to the students.

These benefits, which are outlined in greater detail throughout the report, underscore the belief that naturalistic role-playing merits serious consideration as an effective method of teaching the principles and practices of good interviewing to student personnel workers.

218 pages. $2.85. Mic 57-1278

EDUCATION, ADULT

A MOTION STUDY FOR THE DESIGN AREA OF THE RETAIL FLOWER SHOP

(Publication No. 20,409)

Raymond Thomas Fox, Ph.D.
Cornell University, 1956

The work presented in this thesis is an exploration of one aspect of the retail florist business. It is an attempt to provide a solution for the elimination of waste motion in the design function in the retail florist shop.

The general purpose of the study was to see how the layout of the design area affected the movements of the designer. The specific objectives were to determine the amount of distance traveled in filling a standard order; to determine how shop layout could be changed to facilitate motion economy; and to determine the amount of distance (motion) that could be saved in line with the principles of motion economy.

In order to have definite examples of existing flower shop conditions, a survey of florists within a 50 mile radius of Ithaca, New York was taken. Floor plans were drawn which showed the position of the design or work area in relation to the rest of the shop area. Activity charts were drawn to show the distances from the design table to the materials used and operations carried on by the designer. Flow charts of individual orders were made to get an accurate measure of distances traveled.

After the plans and flow charts were drawn to scale, the shop plans were revised to conform to motion economy principles. A design table was planned which included storage places for all materials constantly in use (active storage). With the new design table as a basis for measurement, theoretical identical orders were followed through to check on the amount of distances traveled.

It was found that poor planning in layout of the flower shop design area resulted in lost motion in every case. At the same time, if the shops were revised to include a well stocked design table, motion was considerably decreased in all cases. In answer to the specific objectives of this study, the following conclusions were drawn: 1. A saving of an average of 71.5% of the distance traveled in filling the original case orders was affected by a revision of the layout of the design area. 2. In replanning the layout of the flower shop, the most fixed feature is the built-in refrigerator. To conserve motion the design table must be placed as close to the storage refrigerator as possible. Other features which must be given basic consideration in the layout of the design area are the placement of stock containers, stuffing, sink, ribbon supplies and delivery table. These should be incorporated in the design table itself, or be placed as close to it as possible. 3. The design table should accomodate all materials regularly used in the design function. A complete storage unit to house supplies for an entire day's work is needed. While the revised shops did not have the maximum motion economy, they formed a composite which resulted in the maximum motion economy with the least amount of change.

The data obtained were used as a basis for relocating basic supplies in order to conserve body motion, to change the work sequence, and to design a florist table as a single work station.

It should be possible to make use of the design table devised in this study to make further studies involving time and motion, and individual operation methods. These studies would be of great help in determining work standards, and in raising the level of output of the designer.

Labor is the biggest expense in the flower shop. Florists must take advantage of every way to conserve motion. This motion energy can be put to work to promote and serve more business. The result would be greater sales, more profit, and a generally more healthy Floriculture Industry at the production level where there are surplus flowers, and at the retail level where there is a consumer deficit. 125 pages. $2.00. Mic 57-1279

A STUDY OF CONFERENCE GOALS AS RELATED TO THE PLANNING AND EVALUATION OF EDUCATIONAL CONFERENCES

(Publication No. 20,076)

James Donovan Jackson, Ed.D.
Michigan State University, 1956

The educational conference has become a significant medium for the professional growth of public school teachers in Michigan. The literature on conferences, while extensive and comprehensive, has lacked research that would focus attention on the components of conference methodology with relationship to the conference as a total learning situation.

The principle purpose of this study was to analyze and compare the conference goals of teachers who attended and those unable to attend, a selected group of educational conferences at Michigan State University. Relationships between the expressed goals of the teachers and certain biographical characteristics were presented; planning, administrative, and evaluative procedures were analyzed, and the ways in which individual goals were met as a result of attending the conference were examined.

Methods and Procedures

After conducting two pilot studies, five educational conferences for public school teachers, meeting annually at Michigan State University, following similar conference program design, and similar in administrative structure and educational purpose, were selected for the final investigation. Four measuring instruments were devised: (1) a pre-conference questionnaire was administered to the conference participants; (2) a similar questionnaire was mailed to the non-participants; (3) an evaluation form was administered to the participants; and (4) a questionnaire was completed by planning committee members of the participating conferences.

Analysis of the Data

While the participants represented a younger portion of the sample, the group presented a rather uniform age distribution. A majority of the sample represented class A schools and taught in the southern half of the state. One-third of the participants attended the conference of their professional organization for the first time while an equal percentage of the non-participants had not yet attended a conference of their teacher organization. Little variation between participant and non-participant attendance at conferences for teachers was noted.

The participants and non-participants were in close agreement concerning individual and over-all conference goals. The members of the planning committees were in closer agreement with the goals of the participants than with the non-participants. The attraction of a name speaker and administrative support were important influences in the individual decision process. The sample reflected confidence in their respective planning committees for the recognition of membership needs and interests in planning the conference. The preferred meeting arrangement consisted of speakers and group discussions on a single topic. The unstructured meeting was least preferable. The data revealed little evidence of procedures for planning committee orientation to conference methodology. Three-fourths of the participants made no planning preparation for conference participation. A majority of the sample favored the provision for conference reporting to the local staff.

Most program personnel were briefed as to over-all conference purposes and were selected, for the most part, on the basis of merit and experience. The conferences were planned by a committee appointed by the organization governing body, and made decisions by majority vote. Indecision was noted on the part of the planning committee as to their conference evaluation provisions.

The participants showed great satisfaction with the role of the conference in achieving personal and professional goals. Goal satisfaction was related to benefits from group discussions, information related to the topic, suggestions received from the speakers, and an inspiration to do a better job.

Conclusions

The findings reflect the existence of a profession of teachers rather than arbitrary divisions known as conference participants and non-participants. The identity and import of conference goals motivating participant attendance were substantiated while certain weaknesses in planning, administrative, and evaluative procedures were shown. Evidences of positive goal satisfaction as a result of attending the conference were confirmed.

237 pages. $3.10. Mic 57-1280

EDUCATION, HISTORY

A HISTORY OF CITIZENSHIP EDUCATION IN OREGON'S PUBLIC SCHOOLS

(Publication No. 20,435)

William Travis McLean, Ed.D.
Stanford University, 1957

This study was conceived as an attempt to trace the historical development of citizenship education in Oregon's public elementary and secondary schools. The research was limited to the role of the social studies although education for citizenship was recognized as an objective of the total school program. No attempt was made to identify other forces to which the child might be subjected. Many other agencies such as the Boy Scouts, Girl Scouts, churches, and family life undoubtedly make many contributions but were not considered. Nor was the effectiveness of Oregon's citizenship education program determined.

In order to trace the development of citizenship education in Oregon schools, the writer examined many factors such as the political, economic, and social history of the state; the influence of the state legislature; the contributions of various professional educational agencies; and the influences of the practices of nearby states. All of these factors had, in varying degrees, a role in developing citizenship education as it exists in Oregon in 1955.

The necessary data were obtained through an analysis

of state courses of study, courses of study for selected school districts, reports of the State Superintendent of Public Instruction, State Textbook Commission, statutes passed by the state legislature, and rules and regulations of the State Board of Education. In addition, newspapers, educational journals, and general histories of Oregon were consulted. Following the collection of data a synthesis establishing relevant relationships between the various factors was completed. Utilizing both a topical and chronological format enabled the writer to relate the various facets and to establish them in proper perspective.

Links were found between the public school movement in citizenship education and many of the dominant trends in Oregon's history. Following the Civil War, Oregon's state educational system was created. The Spanish-American War gave impetus to state prescribed courses of study for grades one to twelve. Days for special observance were adopted. Civics was added to the courses in history and geography. Teacher training was extended and the licensing of teachers became an exclusive state function. Following World War I, the state legislature required the teaching of the United States Constitution, and the principles of honesty and morality. The use of a teacher's oath was also inaugurated. Preceding and following World War II, the need to devise means for improved classroom procedures in teaching the principles of democracy and the dangers of totalitarianism became paramount in citizenship education.

As a means for promoting the principles of democracy, the writer recommends the increased use throughout Oregon of the Social Living Program as developed in Eugene schools. Their program provides opportunities for democratic practices through student activities such as panel discussions, the use of parliamentary procedure, and field trips.

T. C. Holy's survey of Oregon's public schools discovered a deficiency in the teaching of history and geography. More courses were not recommended, but rather a change in classroom procedures resulting in an emphasis on the teaching of these areas.

Oregon has several statutes dealing with citizenship education. Such statutes tend to make the school curriculum inflexible by requiring the teaching of a specified subject. A better procedure might be to leave curriculum construction to educators advised by lay groups. Such procedure would make possible a more flexible school program which could change with the evolving requirements of citizenship in Oregon.

The finished study is thought to provide a rather complete description of the factors which have been basic in the development of Oregon's citizenship education program. It is hoped the completion and synthesis of data will enable social studies teachers, curriculum makers, civic and patriotic groups, and state legislators to formulate an ever increasingly vigorous program of social education.

296 pages. $3.80. Mic 57-1281

A STUDY OF THE HISTORY OF THE CONTRIBUTION OF THE AMERICAN MISSIONARY ASSOCIATION TO THE HIGHER EDUCATION OF THE NEGRO – WITH SPECIAL REFERENCE TO FIVE SELECTED COLLEGES FOUNDED BY THE ASSOCIATION, 1865-1900

(Publication No. 20,423)

Joseph Norenzo Patterson, Ed.D.
Cornell University, 1956

The objectives of this study are:

1. To determine the forces which gave rise to the American Missionary Association.
2. To trace the development of five colleges established by the Association.
3. To search for an understanding of the successes and failures of the Association's educational efforts among Negroes.

The writer, in working with these objectives, not only traces, to a degree, the development of higher education for Negroes, but also presents the particular dilemmas faced by the colleges of the Association.

Among the important questions inherent in the purpose of the study are:

1. In what ways was the Association a unique educational force among Negroes?
2. What were the peculiar emphases in the Association's educational objectives?
3. How did those objectives crystallize in curriculum development?
4. To what extent did the conflicting ideologies -- industrial education versus academic education -- affect the nature of those institutions?

The study seeks to show how an inherently religious organization attempted to solve the freedman's greatest educational needs.

The five colleges chosen for this study -- Fisk, Talladega, Atlanta, Hampton, and Straight -- are those four-year colleges of American Missionary Association origin which are, with the exception of Straight, still important centers for the education of Negroes today.

The years which the study covers are those years which embrace the origin and the development of the American Missionary Association to the approximate time when changes occurred in the internal structure of both the Association and its colleges.

Summary

The American Missionary Association was the outcome of the religious and social climate of the first half of the nineteenth century. The institution of slavery was incompatable with the new philosophical religions, Unitarianism and Transcendentalism, which were capturing the minds of New England in this period. The abolition of slavery and the education of the slaves and freedmen became the consuming interest of a wealthy corps of Christian men and women after the Amistad incident of 1839. This interest was crystallized in the organization of the Association in 1846.

The educational objective of the Association could not be immediately realized due to the laws forbidding Negroes to engage in study or whites to teach them. The Association followed the Union armies in the South, and established schools at vantage points for the education of

thousands of ex-slaves. Philosophical questions were posed at the outset relative to the educability of the Negro, the type of education best suited to his needs, and the extent to which the Negro should be educated.

Because of the Association's policy of allowing the presidents and faculties of the schools a free hand in setting aims and establishing curriculums, Hampton alone developed into an industrial training school; Fisk, Talladega, Straight, and Atlanta developed into liberal arts colleges, since most of the founders and leaders in those schools were the products of the classical curriculums of Harvard, Yale, and Dartmouth.

Despite the great 'industrial versus classical education' debate which burdened the colleges for over two decades, the major contribution made by the colleges during the period of this study was in the field of teacher training.

Perhaps the greatest contribution the Association made was to endow the schools with a spirit which refused to accept prejudices of many varieties as deterring factors in the education of a people. 346 pages. $4.45. Mic 57-1282

THE DEVELOPMENT OF THE GUIDANCE CONCEPT IN THE COLLEGE SOCIAL FRATERNITY

(Publication No. 20,351)

James Harding Siske, Ed.D.
University of Virginia, 1956

The purpose of this research study was to determine what college social fraternities have done in the past and are doing in the present to provide guidance for their members. The assumption is that many college social fraternities try and do give their members help in the way of guidance activities through their fraternity programs.

The study was carried out with the full endorsement of the National Interfraternity Conference. Questionnaires were sent to the headquarters of sixty-two national fraternities, to 146 fraternity chapter officers on the college level, to the dean of men in the seventy-five colleges and universities where these chapters were located and to fraternity historians in each of the national headquarters. Fraternity pledge manuals were also surveyed for their content and also for emphasis that they gave to guidance activities.

Guidance activities in this study covered those activities and services encouraged by fraternities for their members in order to help them adjust to their surroundings, develop their personalities, become adept in the social graces, stimulate better scholarship, and live a life of high ideals that will prepare them for a more successful life after leaving college. The following are related to such activities: study rooms, scholarship awards, pledge training programs, chapter libraries, and use of fraternity advisers or housemothers.

National headquarters reported that many of their chapters had scholarship committees, that they withheld initiation of pledges with poor scholarship, that the pledge manual emphasized scholarship training, that advice and counsel was available to members through chapter "Big Brother" systems, pledgemasters, faculty advisers and visiting officers representing the fraternity. Social activities in the chapter house were encouraged by a majority of the national headquarters along with encouragement for members to participate in college extra-curricular activities, athletic participation, inter-chapter visitation, attendance at church in groups at frequent intervals, and the use of parliamentary practices in weekly fraternity meetings. Fourteen national headquarters considered their guidance programs very successful, six considered their programs effective, while five lamented the lack of personnel or the money to carry out the type of guidance program they desired.

College fraternity chapters indicated that their chapters carried out many of the activities reported and encouraged by their national headquarters. Many chapter guidance programs were rated as being either highly or moderately successful while a small minority were rated as being fairly successful in meeting the needs of their members.

Deans of men considered the ideal fraternity-administration relationship as being one of mutual respect and as constituting a team approach to problems encountered.

Fraternity historians indicated that many guidance activities in fraternity chapters had their beginnings with the founding of the fraternity, while other activities had no specific year of beginning--that they just grew with the fraternity.

The majority of national headquarters reported that their chapters participate in guidance activities relating to: pledge orientation, pledge scholarship, personal guidance, chapter house guidance, group living and related activities for members, and group guidance. It was found that many pledge manuals contain articles encouraging scholarship and give hints on how to study more effectively. They also encouraged conduct becoming a gentleman, listed and explained rules of etiquette, and stated fraternity declarations of principles and objectives. In addition to the above activities, some manuals contained articles relating to vocational guidance. The writer was able to determine that in institutions where good fraternity chapters are reported there exists a spirit of mutual cooperation and respect between fraternities and college administrations. Benefits gained through fraternity membership relate mostly to social, group living, and friendship aspects of college life.

722 pages. $9.15. Mic 57-1283

EDUCATION, PHYSICAL

THE ESTABLISHMENT OF CRITERIA FOR THE EVALUATION OF PHYSICAL EDUCATION ACTIVITIES ON THE ELEMENTARY LEVEL

(Publication No. 20,000)

George Francis Ockershausen, Ed.D.
New York University, 1956

Criteria for the evaluation of physical education activities on the elementary level are established and the process and techniques of performing the evaluation on a selected sample of forty-four activities are demonstrated in this study. From a chart of the characteristics of growth and development which was formulated by means of a compilation of the best sources of information available, the needs of children, and the implication of these

needs for physical education were delineated. From this information, and by a study of the literature in biology, physiology, anthropology, sociology, and psychology, the criteria for evaluation of activities were established and validated. A specific framework was followed to show that all phases of development were covered, that the criteria were essential to the developing child, and that physical education activities can satisfy these needs. Definitions and summarizations of the components comprising the factors established the validated as evaluative criteria are stated in a folder of instructions for judges making the rating of activities.

The great number of physical education activities on the elementary level made it impractical to evaluate all the activities as a part of this study. A selected sample of forty-four activities was chosen from a detailed functional classification of elementary physical education activities, the assumption being, that if these activities could be rated, it was also possible to rate any other activities in the classification.

The selected activities were evaluated upon the premise that elementary physical education activities have varying potentials inherent in the activity to provide opportunities for the participants to experience situations in which they might achieve the various criteria, which are the developmental needs previously established. The selected activities were placed on rating cards according to a specific framework which made all the factors in the teaching situation uniform except for the activity itself. The rating was performed on the principle of "more or less" value being inherent in the activity to achieve the criterion as compared to the other activities. The activity rating cards are arranged by the judge in piles of gradually decreasing value until all cards in a pile are of equal value. The activities having the highest relative value are rated at ten points. Each succeeding pile is numbered one less down to the number one. The results of the ratings are tabulated according to criteria, developmental areas, and total developmental value. Some of the best principles which have been previously formulated for the selection of physical education activities are enumerated as a background for the principles formed as a result of this study for the adaptation of evaluated activities. Specific steps are stated as the proper procedure for the use of the guiding principles.

This study has established the process, techniques, and evaluative criteria by which all elementary physical education activities may be rated as to their relative inherent potential opportunity for participants to achieve developmental needs. The guiding principles and methods for adapting the evaluated activities to the program are formulated. 525 pages. $6.70. Mic 57-1284

AN EVALUATION OF CURRENT PRACTICES IN FINANCING INTERSCHOLASTIC ATHLETICS IN THE NEW YORK CITY HIGH SCHOOLS

(Publication No. 20,292)

William Rosenthal, Ed.D.
New York University, 1956

Chairman: Professor Raymond A. Weiss

Purpose of the Study

The purpose of the study was to evaluate current practices in financing interscholastic athletics in the high schools of New York City. These practices were evaluated against educational and financial principles which apply to interscholastic athletics. In the light of the adequacy or inadequacy of the practices, specific recommendations were made.

Need for the Study

The inability of some New York City high schools to finance their athletic program has caused concern not only to coaches, athletic directors, G. O. advisors and principals, but also to the Superintendent of Schools. In 1953 the Superintendent appointed a committee to make a study of the problem. The committee recommended that an appropriation of $85,000 be appropriated for the purpose of supporting the athletic program. This was known as the Grant-In-Aid program. From time to time similar studies had been undertaken by the General Organization Advisor's Association and the Public Schools Athletic League.

The Procedures

The procedures used were: (1) a study of recent authoritative literature; (2) a survey by means of a questionnaire; (3) interviews and discussions with school administrators, athletic directors, coaches and General Organization Advisors in the New York City public High Schools; (4) correspondence with athletic directors in other cities; (5) personal observation of athletic contests; (6) the personal experience of the investigator as a teacher, chairman, coach, referee, athletic director and athletic representative to the Public Schools Athletic League for the past twenty years.

A series of educational and financial principles relating to the interscholastic athletic program were developed and validated by means of the literature. These principles were used as the measuring unit in evaluating the current practices for financing the interscholastic athletic program, which were developed by means of a questionnaire.

Conclusions

The study indicated that the situation with respect to current practices in financing the interscholastic athletic program in the New York City high schools is good. Evaluation of current practices revealed a preponderance of strengths over weaknesses.

The analysis of current practices reveals that educational and financial principles are generally met in the following instances:

1. Tax funds are used to help support the interscholastic athletic program.
2. Paid, properly qualified and approved officials are used to referee athletic contests.

3. G. O. dues are collected for student membership in the General Organization and these funds are used to help support the athletic program.

4. A nominal admission fee is charged for admission to athletic events and these funds are used to help support the athletic program.

5. A central school account is used for the deposit of all athletic funds.

6. The budget is properly prepared and approved before the expenditure of funds.

7. All athletic accounts are supervised by an accountant or faculty treasurer.

The analysis of current practices reveals that educational and financial principles are not fully met in the following instances:

1. Twenty four percent of all high schools are not receiving Grant-In-Aid Funds from the Board of Education for the support of the athletic program.

2. Students are generally required to pay their own transportation expenses.

3. Athletic insurance is generally not provided for participants.

4. Overnight trips are generally not provided for participants.

5. The vocational high schools generally have no income from gate receipts.

183 pages. $2.40. Mic 57-1285

EDUCATION, PSYCHOLOGY

A COMPARISON OF THE PERFORMANCE OF SELECTED PUPILS ON THE DAVIS-EELLS TEST AND THE OTIS TEST OF MENTAL ABILITY

(Publication No. 20,748)

Glynn Edious Clark, Ed.D.
Washington University, 1957

Chairman: Adolph Unruh

This study compares the performance of Negro and white children on two group intelligence tests, one a test purported to be culture-fair and the other a commonly used verbal-type test. Entire classes of Negro and white children of the fourth grade were arranged independently within each racial sample into three socio-economic groups which were representative of low, middle, and high socio-economic areas of Saint Louis, Missouri. The three Negro groups included 361 children and the three white groups included 362 children.

The performance of the six socio-economic groups on the Davis-Eells Test of General Intelligence or Problem-Solving Ability, Elementary A, and the Otis Quick-Scoring Test of Mental Ability, Beta Test, Form CM, was studied. Comparisons of performance of the total Negro group and the total white group and comparisons of the various groups were made. Partial, multiple, and zero order correlation techniques were employed with the total sample.

First Hypothesis

Children of schools which serve communities of low socio-economic levels should score higher on a culture-fair intelligence test than on a commonly used intelligence test which is heavily dependent upon reading ability, vocabulary skills, and verbal reasoning power.

This hypothesis was found to be untenable for both Negro and white children of this study.

Second Hypothesis

The differences between the means of the intelligence quotients of three groups of children selected by grade units from low, average, and above-average socio-economic areas will be smaller when measured by a culture-fair test than when measured by a verbal-type test.

This second hypothesis was found to be tenable for Negro children but not for white children. There were no significant differences between the mean intelligence quotients of the three socio-economic categories of Negro children as established by the Davis-Eells Test, but the mean quotients did not exceed 84.32 in any case.

The three groups of Negro children, however, obtained higher mean intelligence quotients on the Otis Test, which reflected the relative socio-economic classification in two instances. These mean intelligence quotients were 85.25, 92.36, and 93.40, and differences large enough to be considered significant were obtained between the low group and the other two socio-economic categories.

For the three groups of white children, the Davis-Eells Test yielded differences in mean intelligence quotients that appeared to be significant. The means ranged from 88.63 to 106.74. Results on the Otis Test for white children were similar to those for the Negro children except that mean intelligence quotients were appreciably higher.

Third Hypothesis

The intelligence quotients of the Otis Quick-Scoring Test of Mental Ability, Beta Test, CM, are better predicted by a knowledge of race and socio-economic level than are the intelligence quotients of the Davis-Eells Test of General Intelligence.

This hypothesis was tenable as investigated within the total sample including 723 children of both races. The coefficients of multiple correlation between the intelligence quotients from the Davis-Eells Test and relative socio-economic level and race variables functioning as a team was .53, but a similar multiple correlation coefficient computed from Otis results was .63.

Tentative Conclusion

It would appear from the results of this research that there is no reason to conclude that the Davis-Eells Test offers any appreciable advantage at the fourth-grade level to the less-favored economic groups or to Negro children in urban Saint Louis. 129 pages. $2.00. Mic 57-1286

THE RELATIONSHIP OF CERTAIN ADOLESCENT DEVELOPMENTAL TASKS TO HI-Y MEMBERSHIP

(Publication No. 17,359)

Richard E. Hamlin, Ph.D.
The University of Nebraska, 1956

Adviser: Charles O. Neidt

The purpose of this study was to determine the relationship between membership in Hi-Y and the accomplishment

of adolescent developmental tasks of the boys and girls who belong to Hi-Y organizations.

A paper and pencil inventory of developmental tasks of adolescence, The McCleery Scale of Adolescent Development, was administered to a total of 1,018 boys and girls. These boys and girls represented both Hi-Y and non-Hi-Y young people. Of the 1,018 subjects, 650 became the group on which the present study was based. The other 368 subjects' papers were used for purposes of comparison.

Total McCleery scores were subjected to an analysis of variance for their significance in relation to nine control variables. Next, ten individual developmental task scores were analyzed for their significance in relation to the criterion, membership or non-membership in Hi-Y. The analysis of variance was also used for this latter purpose.

Two developmental task scores were found to be significantly related to the criterion of membership in Hi-Y. These two task scores were subjected to an analysis of covariance. This analysis of covariance was used in order to test the significance of individual and combined controls (Sex and Academic Achievement) for their relationship to the McCleery scores of Hi-Y members and non-members.

An analysis of variance was made of total McCleery scores for those Hi-Y members who had been members of their respective clubs for one, two, three, and four years.

A supplementary device was added to the McCleery Scale. This device made it possible to obtain an expression from the subjects as to whether or not they were receiving help from Hi-Y and other organizations with respect to the ten developmental tasks.

Findings

1. Hi-Y and non-Hi-Y young people differed significantly with respect to the task "Achieving a masculine or feminine social role", with the control of academic achievement held constant. Hi-Y boys, as a group, were found to be more concerned with the task of achieving a masculine social role than were non-Hi-Y boys.
2. Hi-Y boys' scores revealed significantly less concern for the task "Desiring and achieving socially responsible behavior" than Hi-Y girls, non-Hi-Y girls, and non-Hi-Y boys.
3. Better academic achievement was found to accompany Hi-Y membership.
4. Length of time in Hi-Y was not found to affect total task development, as reflected in total McCleery scores.
5. Hi-Y boys and girls indicated by their ratings with a supplementary device that their Hi-Y clubs helped them most with the items comprising the tasks "Developing intellectual skills and concepts necessary for civic competence" and "Desiring and achieving socially responsible behavior".

It was concluded that Hi-Y may select or attract boys and girls who (1) are higher academic achievers; (2) have less concern about the task of "Desiring and achieving socially responsible behavior". Hi-Y clubs seem to attract boys who are more concerned than their non-Hi-Y peers with the task of achieving a masculine social role.

Measurement of expressed concern about adolescent developmental tasks seems to be an effective method for local Hi-Y clubs to use in relation to program planning.

153 pages. $2.05. Mic 57-1287

THE CONTENT OF AN INTRODUCTORY COURSE IN EDUCATIONAL PSYCHOLOGY IN TEACHERS COLLEGES AS DETERMINED BY A CRITICAL ANALYSIS AND EVALUATION OF CONTEMPORARY TEXTBOOKS IN THE FIELD

(Publication No. 20,284)

Howard Jordan, Jr., Ed.D.
New York University, 1956

Statement of the Problem

The purpose of this study was to critically analyze and evaluate the contemporary textbooks in educational psychology for the purpose of determining what should be the content of an introductory course in teacher-training institutions. This analysis and evaluation was made in terms of the goals and objectives of teacher education.

The Problem and Its Importance

Students who plan to become teachers are required to have some training in educational psychology, but state certification requirements are often very vague as to what this training is supposed to contain. An investigation of bulletins of teachers colleges readily reveals that in many instances only one course in educational psychology is required of prospective teachers, and this course is an introductory course. Obviously, then, any single course in educational psychology must select from the whole field those materials which are of the greatest value to teachers.

A careful examination of textbooks in educational psychology reveals a wide divergence in the subject matter selected. It shows that content varies from author to author. This study, then critically analyzes the contemporary textbooks in the field in order to determine the content of most functional worth for an introductory course in educational psychology.

Procedure

The data concerning the content of an introductory course in educational psychology in teachers colleges were determined by a critical analysis and evaluation of twenty-two textbooks commonly used by teacher-education institutions in the country. The following basic procedure was selected:

1. Selection of textbooks for examination, analysis and evaluation
2. Selection of topics
3. Setting up of a criteria for the scope of topics
4. Arrangement of topics
5. Evaluation of topics

The table of contents and the index of each book were examined and a page-by-page analysis made to secure paragraph headings and topics covered. After screening out duplications, a check list of five hundred twenty (520) topics under fifteen headings was submitted to a panel of one hundred one (101) educational psychologists with the request that they rate the topics in the order of importance on a one to four scale. Eighty-five or 85 per cent of the judges responded.

The data secured from the questionnaire were treated both statistically and analytically. Tables were prepared for the fifteen sections of the questionnaire summarizing the evaluation in terms of responses and percentages of

replies in each category. From these data recommendations were made as to the major points of emphasis which should be covered in an introductory course.

Findings

The following is a brief summary of the findings of this study:

1. The product-moment correlation of two random samples of thirty judges yielded an r of .62 and two random samples of forty judges yielded an r of .65. When tested, these coefficients were found to be significant at the 1 per cent level of confidence.

2. The findings indicate that topics of most value for an introductory course are those which seemed to get at practical aspects of understanding and improving efficiency in learning. Topics dealing with history, theories, schools of psychology, experiments and experimental data, with detailed specifics, received lower ratings in terms of value for an introductory course.

3. The topics having the highest mean ratings come under the following general headings: Growth and Development; b. Learning; c. Personality and Adjustment; d. Motivation, and e. Individual Differences and the School. This suggests that major emphasis and concentration should evolve around these topics.

Conclusions

Evidence from this study indicates that the content of an introductory course should be carefully selected to include the subject matter which is most important in helping teachers solve their classroom problems.

Specifically, major emphasis should be given to topics which help teachers improve the efficiency of learning; give an understanding of pupil behavior; help in efficient personality development and adjustment; and improve the mental health of both teacher and pupil.

159 pages. $2.10. Mic 57-1288

RELATIONSHIPS OF CERTAIN PERSONALITY CHARACTERISTICS TO COLLEGE ACHIEVEMENT

(Publication No. 20,645)

Stanley Brittain Quinn, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor A. H. Edgerton

The purpose of this study was to investigate the relationships of certain personality characteristics of men, as measured by the Minnesota Multiphasic Personality Inventory (MMPI), to college achievement. To accomplish this purpose, the specific objectives of the study were:

1) to empirically construct a personality scale on the MMPI, relatively independent of academic aptitude and positively related to academic achievement, and

2) to attempt to define the personality characteristics related to achievement by determining the extent to which each of the MMPI standard scales contributes to this non-intellectual scale.

Two experimental achievement scales were devised by selecting MMPI items which correlated significantly with first semester freshman grade point average (GPA) but which demonstrated an opposite or nonsignificant relationship with the American Council on Education Psychological Examination (ACE). Each MMPI item was correlated with GPA and with ACE by two separate item analyses for samples of male students from each of the three freshman classes of 1949, 1950, and 1951 at the University of Wisconsin. Items were therefore selected on the basis of the consistency with which they fulfilled the non-intellectual achievement criterion over the three-year period.

The first scale, termed Non-Intellectual Achievement (NIA), contained all the significant (.05 level) differential items of the MMPI. The second, termed Non-Intellectual Achievement-Short Form (NIAS), contained only the most highly significant (.01 level) differential items of the first scale.

The cross-validation results of the two scales on three additional samples of male freshman indicated that as a single predictor of first semester grade point average for male freshman the NIA scale is slightly superior to the NIAS scale. However, both scales demonstrated only a weak relationship with college achievement. Neither NIA nor NIAS offered any practical increase in the predictability of male freshman achievement beyond the contribution of intelligence (ACE) and rank in high school graduating class (HSPR).

Since the NIA and NIAS scales correlated significantly --though weakly--with GPA (.01 level in two of the three cross-validation samples) and were found to be relatively independent of intelligence (non-significant at .05 level in two of three cross-validation samples), an attempt was made with the two scales to define the differential personality characteristics of under and overachievers. The items of the two achievement scales were scored twice on the MMPI standard scales, once in favor of high achievement and again in favor of low achievement. No outstanding differences were observed by comparing the number of achievement scale items appearing on the MMPI clinical and validating scales between the two scorings.

It was suspected that the putative non-intellectual personality traits associated with achievement, defined by past investigations, are in reality related significantly to intelligence. To test this hypothesis an intelligence-related achievement scale (Ach) was developed, by selecting items solely on the basis of their significant relationship (.01 level) with GPA, and scored for low and high achievement on the MMPI standard scales. Outstanding differences were evident with higher scores in favor of low achievement on the F, Pa, Pd, and Sc scales, the last three of which supported the general findings of past MMPI studies in this area which supposedly controlled the influence of intelligence.

In conclusion, the important findings of this study were:

1) The inclusion of either NIA or NIAS in the typical freshman battery of tests for the purpose of adding to the predictability of college achievement for men is not warranted.

2) When intelligence was properly controlled the MMPI standard scales failed to define the differential personality characteristics of under and overachievers.

3) Many of the MMPI personality characteristics found in past studies to differentiate under and overachievers actually can be ascribed to the influence of intelligence.

236 pages. $3.05. Mic 57-1289

ADJUNCTIVE THERAPY PROGRAMS AND BEHAVIOR CHANGES IN CHRONIC SCHIZOPHRENIC PATIENTS: AN EVALUATION OF BEHAVIOR CHANGES RESULTING FROM ATTENTION DIRECTION IN ADJUNCTIVE THERAPY PROGRAMS

(Publication No. 20,293)

Thomas J. Ryan, Ph.D.
New York University, 1956

Chairman: Professor Charles E. Skinner

The purpose of this investigation was to determine the extent to which the factor of attention given to hospitalized chronic schizophrenic patients and their participation in adjunctive therapy activities effected their social and interpersonal adjustments, as measured by behavior rating scales.

From a population of long-term, chronic schizophrenic patients on two wards of a large neuropsychiatric Veterans Administration Hospital, four groups of fourteen patients each were equated on profiles of ratings on the Montrose Behavior Rating Scale and on age. The four groups were assigned to different experimental programs. Two groups received an emphasis of warm attention from all personnel while attending different programs of adjunctive therapies. A third group followed the same program of activities as one of the first two groups, but did not receive warm, personalized attention from the staff. The fourth group of patients remained on the ward relatively inactive. No other forms of therapy such as drugs, psychotherapy or shock therapy were given during the four-month period of the experiment. The efforts of the staff were directed towards the two attention-activity groups by discussion of patients in many conferences and by having the staff rate the patients on a second rating scale and forward periodic progress notes.

During the four months of the experimental programs, patients dropped from each group. At the conclusion of the experiment, means of scores of rematched groups were compared to determine the changes in behavior resulting from the attention paid to the patients and attending activity programs. One group of patients who received the personalized attention of the staff throughout the four-month period showed an improvement in behavior approaching significance. The second group which also received the attention of the staff but which attended a program of activities different from the first group showed an improvement in behavior to a less extent than the first group. The group which attended activities but which did not receive attention showed a slight decrease in level of behavior. The control group which remained on the ward showed an improvement in behavior but to a less extent than the first group.

The improvement in behavior of the two groups receiving the personalized attention of the staff was not significant when compared to the improvement of the control group which remained on the ward or when compared to the slight regression in behavior of the group which was assigned to activities but did not receive attention. However, the slight decrease in behavior level of the latter group was not significant when compared to the improvement in behavior of the other three groups, nor was the improvement in behavior of the control group which remained on the ward significant when compared to the changes in behavior of the three groups which attended activities. The basic hypotheses that receiving the attention of staff and attending programs of adjunctive therapies would result in significant improvement of chronic schizophrenic patients were not substantiated.

A review of the ratings made by the ward and adjunctive therapy personnel and of the progress notes forwarded by the latter indicated that the groups showed no significant changes although certain patients appeared to change considerably in their behavior.

It was noted that a period of four months is a short interval of time in the lives of long-term schizophrenic patients so that the changes in behavior of the two attention-activity groups may indicate a positive gain. However the mere assignment of patients to activities without consideration of other factors may actually result in patient regression. It was observed that previous investigators determining the effects of various therapies had found considerable changes occurring in both experimental and control groups. 173 pages. $2.30. Mic 57-1290

IDENTIFIABLE PERSONALITY CHARACTERISTICS RESULTING FROM MEMBERSHIP IN A CONSPICUOUS RELIGIOUS MINORITY IN PUBLIC HIGH SCHOOLS

(Publication No. 17,591)

Glenn H. Straight, Ed.D.
The University of Nebraska Teachers College, 1956

Adviser: D. A. Worcester

The Problem and Its Delimitations

The purpose of this research was to determine whether members of a conspicuous religious minority in the public high schools tend to develop unique and identifiable adjustment techniques as a result of their high school experience.

Members of the Seventh-day Adventist denomination were chosen as the "conspicuous religious minority." They are readily identifiable in a public high school since they do not participate in Friday night or Saturday school activities.

Techniques Used

This study included about fourteen hundred Seventh-day Adventist graduates from secondary schools. Comparisons are made between: (a) graduates from high schools and denominational schools and (b) between both groups and the typical university freshmen. The significance of the difference between groups is determined by the standard error of the means.

Standardized tests used were the Minnesota Multiphasic Personality Inventory by Hathway and McKinley, the Personality Inventory by Bernreuter, and the Minnesota T-S-E by Evans and McConnel. In addition a four-point rating scale was used. A number of college freshmen from various high schools were interviewed and letters were written to Seventh-day Adventist high school graduates who did not continue their formal education.

Findings

From the Minnesota Multiphasic Personality Inventory

These conclusions were found to be significant:

1. The difference between students from the public schools and the denominational schools was small and in no case did it reach the 5 per cent level of significance.
2. Differences between groups for different years from the same system were as great as the differences between systems.
3. Males were found to be more variable than females and seemed to have a harder time adjusting in both types of previously mentioned schools.
4. On most scales the averages were above the standardized norms. This is consistent with the findings of Goodstein and others.
5. For males the averages given by this inventory tended to be higher than the averages given typical university males.

From the Bernreuter Inventory

No evidence of differences in adjustment between students from high schools and students from denominational schools was demonstrated by this inventory.

From the Minnesota T-S-E

There was a small difference shown by this inventory in favor of the students from public high schools, but the difference was statistically insignificant.

From Interviews and Letters

Most Seventh-day Adventist students felt they had been treated fairly and many adjustments were made to accommodate this religious minority. Several mentioned the problem of Friday night activities and for a few with limited scholastic ability, non-attendance at these activities may have restricted opportunity for recognition.

From the Rating Scales

The most conspicuous finding evidenced by the rating scales was the general belief by the Adventist students that they had been treated fairly by both their teachers and fellow students. There was a slightly higher percentage of Adventist students who attended public high schools as contrasted to students in attendance at academies, who felt "somewhat left out" of school activities. The difference, however, was small.

Conclusions

The Seventh-day Adventist young people who attend public high schools do not seem to have an identifiable adjustment uniqueness which can be demonstrated within the sensitivity limits of the tools used in this research. The differences may pose a problem for a few students. There is some evidence to indicate that this is due to a pattern of causes rather than religious differences alone.

Limitation in Interpretation

The purpose of this research is to investigate adjustment only. It does not involve such questions as the effect on the student's loyality to the denomination, the influence of the association, or effect on his beliefs. Such questions are complicated by the probability of many variables of which the high school experience is only one.

225 pages. $2.95. Mic 57-1291

PSYCHOTHERAPY AND READING TUTORING: EFFECT OF PSYCHOTHERAPY AND READING INSTRUCTION ON READING ABILITY AND PERSONAL AND SOCIAL ADJUSTMENT

(Publication No. 20,296)

Thomas E. Tierney, Ph.D.
New York University, 1956

Chairman: Professor Ernest R. Wood

Problem The close relationship between reading abilities and personal and social adjustment has long been recognized. Recent research has suggested that treatment of children retarded in reading should include psychotherapeutic as well as educational methods. The purpose of this study was to evaluate the affect of individual psychotherapy and reading instruction on improvement in reading ability and personal and social adjustment.

Subjects The 40 subjects employed in this study were selected from a clinic population of retarded readers who had problems in adjustment. They comprised boys between the ages of eight and eleven-and-a-half, whose I.Q.'s ranged from 81 to 118.

Method and Procedure These subjects were divided into four equal groups, matched on the basis of age, I.Q., reading ability, and personal and social adjustment. These groups were given either psychotherapy, reading instruction, both, or no treatment. All subjects were evaluated according to the magnitude of improvement in reading ability and personal and adjustment after the seven-month experimental period.

Results The results were separately organized according to the effects of the various forms of treatment on reading ability, and on personal and social adjustment.

The following results were obtained for improvement in reading.

1. All groups including the control, showed a significant improvement after the experimental period.
2. The order of improvement, from greatest to least, was reading-plus-psychotherapy, reading instruction, psychotherapy, no treatment.
3. The magnitude of improvement was significantly greater in the reading-plus-therapy group than in all others, however, the only other significant difference was that between reading instruction and control.

The following findings were obtained with regard to personality.

1. All of the experimental groups showed significant improvement after treatment; the control group, on the other hand, did not improve.
2. The order of magnitude of change in personality rating from greatest to least was again: reading-plus-

psychotherapy, reading instruction, psychotherapy, no treatment.

3. None of the experimental groups differed significantly one from the other, although all differed significantly from the control group.

Conclusions It may be concluded that the combined use of psychotherapy and reading instruction is more effective in the reading sphere than either form of treatment alone. Furthermore, the differential effectiveness of psychotherapy or reading instruction does not appear to be great, and either is more effective than no treatment.

56 pages. $2.00. Mic 57-1292

EDUCATION, TEACHER TRAINING

AN EVALUATION OF COOPERATIVELY-PLANNED COMMUNITY RESOURCES WORKSHOPS FOR TEACHERS

(Publication No. 20,473)

Albert Lee Ayars, Ed.D.
State College of Washington, 1956

Purpose of the Study

The study is an attempt to evaluate and suggest ways to improve one vehicle (the community resources workshop) designed to promote more effective use of the resources available to the teacher in any community.

Definitions

The word "workshop," as used in the study, refers to a situation in which a group of people gets together to work on a problem of mutual concern. A community resources workshop is one in which teachers strive to acquaint themselves with available teaching resources in the community and to determine how these resources can be utilized more effectively in teaching. It also includes the production of teaching units, resource files, supplementary reading lists, vocational guides, filmstrips, and other materials to implement effective use of community resources in teaching.

Community resources are persons, places, organizations, activities, or things in the community which may serve to enhance the educational process.

Characteristics of Workshops Evaluated

Each of the community resources workshops evaluated was sponsored by a nearby college or university and financed in part by business and other community groups. Planning was done jointly by the teachers themselves and representatives of the sponsoring university, the local school administration, business, industry, government, labor, and other interested groups. The teachers chose their own problems and, with the aid of consultants and advisors, set out to determine precisely what teaching resources were available in the community and how they could be utilized in supplementing textbook learning. Basically the workshop teachers strove to make the community a source of student information and a laboratory in which young people may study the problems of living.

Answers Sought

Through the study an attempt was made to "take stock" of five of these workshops conducted in 1952, 1953, and 1954, and to provide answers to such questions as the following:

Is the knowledge and use of community resources important in teaching? Do teachers accomplish their planned purposes in the workshops? Do teachers in the workshops accomplish purposes deemed important by their supervisors and administrators? Do teachers make greater use of community resources in their teaching as a result of the workshop experience? Do they improve their teaching methods? Do they make greater use of the usual or conventional teaching aids? Do they introduce community-tied topics of study? Do the workshops influence teacher attitudes and participation in community activities? Do in-service development activities result from the workshops? What factors seem to inhibit and what factors seem to expedite later application of workshop learnings? What recommendations may be made regarding the conduct of the workshops?

Procedure Involved in Securing Data

The cooperation of five universities and three testing services was enlisted to give advice on the conduct of the study.

Several techniques were employed to learn the nature of benefits derived from the workshops and to get answers to the questions above.

Professional books, articles, research papers and dissertations were reviewed to determine the purposes claimed for utilizing community resources in teaching, the types of resources found useful, how teachers generally become familiar with these resources, and techniques employed by teachers to utilize community resources. Participating teachers and supervisors and administrators familiar with their work were interviewed regarding the purposes achieved by the workshops. The teachers and their supervisors filled out questionnaires before the workshops began, at the mid-point in the workshops, and at the end of the first semester of teaching after the workshops closed. Through these questionnaires teachers and their administrators were asked similar questions before and after the workshops. Comparisons of the use of teaching techniques and the utilization of community resources by the teachers before and after the workshop were thus possible. Advance questionnaires helped teachers formulate objectives, and later questionnaires helped them evaluate the degree to which objectives were achieved. The participants also wrote out longhand evaluations of the workshops and evaluated them orally in group sessions. Information from all the sources was recorded and studied to determine how the workshops influenced teacher opinion and activities, use of resources, and teaching practices. A total of 136 workshop teachers and 73 administrators cooperated in the evaluation study.

Findings

Now let us briefly summarize the findings, each of

which carries implications for persons planning and operating community resources workshops.

The community resources workshops were found to be an effective means through which the teacher can achieve such important self-chosen purposes as:

Exchanging ideas with other teachers.

Learning about the economy of the area.

Establishing mutual acquaintanceship and understanding with people of industry, business, and other phases of community life.

Becoming better acquainted with materials for class use.

Learning how to conduct study trips.

Making reference files of resources of the area usable in teaching.

Learning of student vocational opportunities and training requirements.

Planning teaching materials.

Learning to use democratic teaching techniques and procedures.

According to the participants and their supervisors and principals, the workshops proved adaptable to the wishes of participants to the extent that the most important purposes were achieved.

One hundred per cent of the participants and their supervisors and principals questioned indicated that they would advise other educators to enroll in a similar workshop.

The participants and their supervisors and principals were in agreement that following the workshop experience the participants' teaching changed noticeably. Ninety-one and six tenths per cent of the teachers and 81.63 per cent of the principals affirmed this point. It was unanimously agreed by this group of principals and supervisors that the teaching was more effective afterward.

Although more research is needed to determine in a conclusive way the nature of the influence of community resources workshops on teacher opinions and their community activities, there is some evidence to indicate that the experience tended to give them a new understanding and appreciation of some of the groups with which they established contacts. For example, a distinctly more favorable opinion on the items listed below was reported after the workshops:

The way business and industry cooperate with education.

The contributions of business and industry to community well-being.

The importance of the local community.

Motives of business and industry in working with educators.

Vocational opportunities for young people in the community.

The workers' place in the community.

The questionnaire respondents (participants, supervisors, and principals) indicated that the teachers engaged in numerous activities during the semester following the workshop to inform other teachers of their workshop experience and to help them develop class activities in accord with their new information, insights, and understanding.

Evidence was provided to support these statements:

The knowledge and use of community resources in teaching is deemed important by educators.

The teachers do accomplish their purposes in the workshops.

These purposes are deemed important by supervisors and administrators.

Teachers do make greater use of community resources as a result of the workshop experience.

Teachers do improve their teaching methods (as judged by themselves and their supervisors) as a result of the workshop experience.

Teachers do make greater use of the conventional teaching aids as a result of the workshop experience.

The teachers do introduce community-tied topics of study as a result of the workshop experience.

The workshops do influence teacher attitudes and participation in community activities.

The benefits of the workshops to teachers, pupils, and the community as a whole are presented in the study. Detailed suggestions for improving the workshops are also listed. 209 pages. $2.75. Mic 57-1293

THE COMPREHENSIVE INDUSTRIAL ARTS LABORATORY IN THE PREPARATION OF INDUSTRIAL ARTS TEACHERS FOR THE PUBLIC SCHOOLS

(Publication No. 20,280)

George H. Ditlow, Ed.D.
New York University, 1956

Chairman: Professor William P. Sears

Purpose of the Study

The purpose of this study was to (1) develop the potentialities of the comprehensive industrial arts laboratory in preparing industrial arts teachers for the public schools of the Northern New Jersey Metropolitan Area and (2) identify implications for industrial arts teacher education from the data gathered and analyzed in the field.

Methods Used

There were three distinct methods used in gathering the data for this study. The first method involved a search of related materials such as books, research studies, articles, documentary bulletins, industrial publications, and literature from teacher education institutions.

The second method was of the normative-survey type. A questionnaire was sent to the 911 industrial arts teachers and supervisors in New Jersey's public schools. The questionnaire was designed to secure specific data concerning the school and the student, the industrial arts programs, and the backgrounds, certification, experience, and future plans of the industrial arts teachers.

The third method was to interview industrial arts teachers, supervisors, and teacher educators. During these interviews, observations were made of the programs and physical facilities used in the public schools and in the teacher education institutions all located within a 200 mile radius of the Northern New Jersey Metropolitan Area.

Findings and Interpretations

The development, status, and recognition attached to industrial arts programs in the public schools and teacher education institutions in New Jersey were presented, analyzed, and compared with similar data from other parts of the country. From these findings, certain conclusions, interpretations, and recommendations were developed in connection with the following points:

1. Confusion existed as to the nature, aims, objectives, and emphases which should be placed upon industrial arts programs. These programs are becoming increasingly integrated with general education and more students were being scheduled for an increasing amount of time within the programs.
2. The facilities were found to be inadequate when considering the age, size, number, and type. Furthermore, there was a distinct lack of qualified teachers particularly in the elementary and junior high schools.
3. The content of the industrial arts programs in the public schools was paralleling the backgrounds and interests of the instructors. More than 75 per cent of the class time was being devoted to instruction in the wood, drawing, and metal areas which were taught from a unit shop approach.
4. Industrial arts teachers were teaching programs as they were taught within the teacher education institutions. They were trained in the unit shop approach with little emphasis being placed upon experiences in the comprehensive laboratory. Furthermore, the two industrial arts teacher-education institutions in New Jersey offer only undergraduate work. Opportunities for in-service or graduate work do not exist. Recommendations for undergraduate, in-service, and graduate programs and the design of a comprehensive laboratory for the functioning of these programs have been included within this study. Further recommendations were developed which could relieve the teacher shortage in New Jersey without overcrowding the present or proposed facilities.
5. The 624 teachers and supervisors responding to the survey indicated a need for broader advisory and consultative services in planning new or reorganizing existing industrial arts programs. Recommendations were developed to provide for these services.

222 pages. $2.90. Mic 57-1294

FIRST-YEAR TEACHERS' DEVELOPMENT IN COMMUNITY RELATIONS: A STUDY OF THE ACTIVITIES AFFECTING TEACHERS' DEVELOPMENT IN GOOD COMMUNITY RELATIONS WITH SPECIFIC REFERENCE TO FIRST-YEAR TEACHERS IN THE NEGRO JUNIOR HIGH SCHOOLS OF WASHINGTON, D. C.

(Publication No. 20,283)

Lawrence Elmer Graves, Ed.D.
New York University, 1956

Chairman: Dr. Theodore D. Rice

The participation of teachers in community activities is recognized as essential to the improvement and enrichment of school-community relations. There is a need for teachers in urban communities who are not only good classroom teachers, but who are also trained to assist in bridging the gap between the school and the community and to enrich life educationally, socially, and culturally.

This study was undertaken because of the pressing concern regarding the adequacy and the relevancy of the training of urban teachers for effective and wholesome community relations. There was also serious concern as to the extent to which the development of good community relations may be influenced by the training those teachers have received.

This study is based on three major points of reference: (1) A teacher's influence extends beyond the confines of the classroom and the mere academic training of his students. (2) Teacher-preparing institutions should anticipate the needs of the future teacher and prepare him to function in an ever broadening and increasing spheres of responsibility. (3) The roles of a pre-service or an in-service program in preparing junior high school teachers for better community relations can, in part, be evaluated for the purpose of improvement by means of a follow-up study of students who graduated from the pre-service program and are now employed as junior high school teachers in that community.

Data concerning first-year teachers' development in community relations were obtained through: a study and analysis of the pre-service program; the development of a checklist of activities affecting teachers' development in community relations derived from the study of the pre-service program, submitted to groups of graduates from the pre-service program, to selected members of the college faculty, and to principals of the junior high school; study of in-service programs; interviews with selected teachers, college faculty members, junior high school principals and department chairmen.

Findings in the study were:

First-year teachers were frequently confronted in their classroom with activities which pertain implicitly to school-community relations. Experiences which dealt with contacts outside the classroom, with formal as well as informal community groups, occurred less frequently.

First-year teachers had considerable interest in sixty of the sixty-eight activities in this study.

The experiences which were provided in the college curriculum were not significantly helpful to new

teachers and were often not closely related to the activities which occurred most frequently during their first year of teaching. A few specific courses were reported to have been of considerable help.

Extra-curricular activities were considered helpful in some measure by the majority of first-year teachers.

The in-service programs provided some help in the majority of the activities and provided considerable help with those activities which were faced most often by the first-year teachers. They were weakest in regard to those activities related to community experiences and contacts.

These findings lead to the following conclusions: (1) The pre-service program fell short of its avowed aims. (2) First-year teachers were inadequately prepared to handle activities involved in community relations. (3) The in-service programs failed to bridge the gap in the preparation of the new teacher for effective school-community relations.

It is, therefore, recommended that the teacher-preparing institution either strengthen its pre-service offering to increase the prospective teacher's community consciousness and awareness of the teacher's out-of-class responsibilities in a community or select more able students from the standpoint of ability, initiative, and interest. Furthermore, it is recommended that the schools both strengthen their in-service offerings to develop teachers' skills in community relations and endeavor to select only those graduates who have shown in their pre-service training that they possess the personality, the ability, the interest, and the experience to become successful.

309 pages. $4.00. Mic 57-1295

AN APPRAISAL OF THE UNDERGRADUATE PROFESSIONAL PROGRAM IN SECONDARY EDUCATION AT THE UNIVERSITY OF UTAH

(Publication No. 18,705)

Shizuko Nakagawa Harry, Ed.D.
University of Utah, 1956

Chairman: Dr. Leo G. Provost

Problem. The problem of this study was to appraise the undergraduate professional program in secondary education at the University of Utah in order to make recommendations for its improvement. This was a follow-up study to the accreditation visit (January 1954) by the Inter-visitation Committee of the American Association of Colleges for Teacher Education. The program was evaluated on two bases: (1) it was appraised to note whether or not it was providing adequate opportunities for translating the findings from the behavioral sciences into operational concepts which prospective teachers should have to increase their competency, and (2) it was compared with the programs of five selected institutions considered to be outstanding in teacher education at the secondary level.

Sources of data and methods employed. An investigation of the literature on the research in the behavioral sciences was made for principles and concepts that teachers should know and utilize. The subject areas examined were: (1) adolescent growth and development; (2) the processes of learning; (3) group processes; and (4) the relationship of the school and society. Numerous documented statements pertaining to these areas were taken from sources that were considered to present the most commonly accepted thinking by authorities in this field, and representative principles were distilled from these statements. One hundred and two criteria were developed from this investigation and were applied to the six upper division courses (excluding student teaching) required at the University of Utah in professional education at the secondary level. The various types of professional laboratory experiences, which prospective teachers should have, were defined and examined for their contributions in implementing the findings from the behavioral sciences, for it is through direct experiences and clinical situations that concepts have the best opportunity to become operational. The student-teaching organization was compared with those at the five selected institutions.

Conclusions: The improvements which the five selected institutions desired indicated a trend towards: increasing the amount of guided, meaningful experiences which students have with children and youth in the public schools and in community agencies prior to student teaching; increasing the amount of student teaching to full time and also to include internship; and providing concurrent and/or post-student-teaching seminars. These trends were in line with the improvements needed in the Utah program, as found by the application of the criteria.

The comparison of the Utah program with the programs at the five selected institutions indicated the presence of the same needs which were apparent when the criteria from the behavioral sciences were applied to the courses required at Utah.

The principal differences indicated by the comparison were: Utah did not provide professional laboratory experiences prior to student teaching; Utah had the most limited program in student teaching; Utah had no block of class time to allow for better interaction among the professors and students and for more opportunities to observe high-school classes and to participate in some of them; and Utah did not have a curriculum laboratory.

425 pages. $5.45. Mic 57-1296

THE RESPONSES OF HIGH SCHOOL SENIORS TO A SET OF STRUCTURED SITUATIONS CONCERNING TEACHING AS A CAREER

(Publication No. 20,244)

Alfred Harold Johnson, Ph.D.
The University of Wisconsin, 1957

Supervisor: Dr. Arvil S. Barr

This investigation attempted to shed light on the attitudes of 170 high school seniors from four Ohio schools toward teaching as a career and toward various facets of the school. Implications were sought for recruitment, for improvement of teacher status, and for changes in the school.

The chief data-gathering device was a projective technique designed by Leila Stevens, of State Teachers College, Frostburg, Maryland, and used by her in a similar study in Maryland. This device consisted of 11 loosely-structured, ambiguous school situations. The subjects were encouraged to respond freely to these by writing completion-responses.

A minor part of the investigation was the administration of the Bell Adjustment Inventory to all of the subjects, the Kuder Preference Record to one-half the subjects, and the Strong Vocational Interest Blank to one-half the subjects. These were used to secure independent measures for comparison purposes, and to attempt to determine possible relationships between attitudes toward teaching, on the one hand, and vocational interest and social adjustment scores on the other.

Principal Findings

1. Low pay was given as a reason against teaching as a career by 71% of the subjects. This was modified by responses showing that only 38% were able to estimate beginning salaries within the $2900-$3800 range paid in the area. Furthermore, in a different projective situation, opinions expressed about salaries showed the following: 29% said salaries were too low; fair salary was reported by 20%; salaries are improving, 18%; and salaries are good, 8%.

2. Other reasons given against teaching as a career were: children get on your nerves and discipline, 22%; long hours, no spare time, homework, 18%; dull, boring routing, 14%; limited opportunities, 14%; and felt lack of ability, 12%.

3. Reasons given in favor of teaching included: likes children, likes working with them, 52%; interest in helping society, 48%; interest in people, 19%; security, 16%; good people to work with, 54%; good hours, 32%; and job satisfaction, 27%.

4. In an ambiguous situation, 20% assumed that the girl chose teaching, compared to 6% who assumed it was the boy.

5. Discipline problems were emphasized by the following:

   a. A serious discipline problem was envisioned in an ambiguous school situation by 52%, compared with 27% who saw new methods of teaching and a happy, cooperative group.

   b. When the situation had the teacher requesting a conference with the parents, 81% saw trouble, disciplinary and academic.

6. Only 5% described the man who remained in teaching as ambitious.

7. The principal was seen as respected, authoritative, and competent by most.

8. The male teacher was envisioned as an athletic coach or physical education teacher by 32% of the students. Other teaching assignments for a man were mentioned infrequently.

9. The school was described as a clean, pleasant place to work by 70%. Eight per cent saw it as too confining and preferred outdoor work.

10. An unfavorable feeling toward the grade school experience was reported by 58%.

11. Interest in subject matter ranked low as a reason for teaching, viz:

   a. Likes to read and study, 6%.

   b. Liked school, was a good student, 4%.

12. Girls in teaching have as good, or better, chance to marry as anyone, 86%. Women can teach after marriage, 69%.

13. These students were poorly informed about teaching salaries, preparation for teaching, and the cost of such preparation.

14. The following Pearson product-moment correlations were calculated (projective manuscripts were evaluated and assigned an NFR, or Net Favorable Response, score):

   a. NFR and Bell Adjustment Inventory, .037.

   b. NFR and "Social Service" Kuder scores, .68.

   c. NFR and highest "teaching interest" score on the Strong Vocational Interest Blank, .23.

236 pages. $3.05. Mic 57-1297

THE CRITICAL REQUIREMENTS FOR SECONDARY SCHOOL BUSINESS TEACHERS BASED UPON AN ANALYSIS OF CRITICAL INCIDENTS

(Publication No. 20,633)

Robert Manley Kessel, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Russell J. Hosler

Statement of the Problem

This study represents an attempt to determine the critical requirements for the effective performance of secondary school business teachers as revealed by an analysis of critical incidents. Secondary purposes of this study were to determine the relationships between the critical incidents and the major areas of business teacher responsibility and to determine the relationships existing between the critical incidents and certain personal and professional characteristics of the business teachers studied.

The Research Procedure

An adaptation of the research method known as the "critical incident technique" was employed in this study. The critical incident technique is a behavioral approach consisting of a set of procedures for the collecting and analyzing of observed effective and ineffective behaviors relative to the performance of a job or activity.

The critical incident data were obtained through personal interviews with fifty secondary school administrators and fifty secondary school business teachers randomly selected from an area within a fifty-mile radius of Madison, Wisconsin.

Results

An analysis and classification of the critical incidents resulted in four major areas of business teacher responsibility as follows:

Area I - Curriculum Planning and Instructional Procedures

Area II - Classroom Management

Area III - Extra-Class Responsibilities
Area IV - Staff and Community Relationships

The total number of incidents reported by school administrators was rather evenly distributed among the four areas of business teacher responsibility; however, the total number of incidents reported by business teachers was concentrated in Areas I and II. Application of the Chi-Square test indicated these differences to be significant at the one per cent level of confidence.

Effective incidents reported by school administrators were concentrated in Areas III and IV; effective incidents reported by business teachers were concentrated in Areas I and II. These differences were found to be significant at the .005 per cent level of confidence.

No significant differences were found in the distribution of ineffective incidents reported by the two observer groups among the four areas of business teacher responsibility.

Seventeen critical requirements were derived from an analysis of the critical behaviors extracted from the critical incidents.

No significant relationships were found between the critical incidents and the business teachers' sex, age, salary, preparation, teaching experience, and business experience.

Conclusions

1. When evaluating the effective or ineffective performance of secondary school business teachers, school administrators tend to attach as much importance to the non-instructional aspects of the business teacher's position as to the instructional duties.

2. Business teachers appear to be more concerned with their instructional responsibilities than with their non-instructional responsibilities when reflecting upon their own effectiveness or ineffectiveness.

3. Generally, the kinds of problems encountered by business teachers in service and business teacher effectiveness or ineffectiveness in handling problems related to their positions are not significantly related to the factors of sex, age, salary, preparation, teaching experience, and business experience.

4. The critical requirements for the effective performance of secondary school business teachers are related to a large extent to curriculum planning, classroom instructional procedures, guidance and attention to individual differences, and maintaining class control; and, to a lesser extent to assessing and reporting student progress, managing equipment and supplies, extra-class responsibilities, and relationships with other teachers, school administrators, and the community at large.

236 pages. $3.05. Mic 57-1298

THE HISTORY OF THE PSYCHOLOGICAL FOUNDATIONS OF TEACHER EDUCATION

(Publication No. 20,465)

Marian Elizabeth Reed, Ph.D.
Stanford University, 1957

The problem of this study was to trace and analyze the major trends and developments found in the psychological foundations of teacher education during the first half of the Twentieth Century from 1900-1950, and to determine the extent to which these trends and developments were in accord with the social and educational trends of the period.

The procedure employed included (1) an analysis of the social forces, the educational developments, and the psychological and educational thought of each decade, determined from (a) a study of the historical and psychological background of each era, (b) the writing of men eminent in education and psychology, and (c) the recommendations of commissions and committees; and (2) an analysis of topics in the psychological foundations of teacher education considered in representative teacher training institutions during the same period, determined from a study of 1,298 courses taught in sixteen representative institutions at ten year intervals from 1900-1950. This information was supplemented by a study of syllabi, textbooks, questionnaires, surveys, and findings of commissions and committees.

The social and economic forces of the period brought about the transformation of the United States from an isolated, provincial nation to the most influential nation in the world and the development of a people possessed of enormous wealth, vast industrial power, great technological skill, and the highest standard of living the world had ever known.

The educational developments brought about (1) the establishment of a system of public education extending from the kindergarten through the university, educating thirty million students, employing over a million teachers, and producing a nation 97 per cent literate, and (2) the development of a profession of education which, through the preparation required of its members and the quality of research undertaken, was taking its place among the great academic disciplines and the leading professions of the nation.

The educational and psychological thought of the period greatly influenced teacher education through the development of: functional psychology by James, child study by Hall, heredity and environment, measurement, and statistics by Thorndike, guidance by Parsons, intelligence tests by Binet, factor analysis by Spearman, psychoanalysis by Freud, psychometric techniques by Moreno, behaviorism by Watson, evaluation by Tyler, topological psychology by Lewin, emphasis upon emotion in the educative process by Prescott, the Progressive Education Movement, mental hygiene, Gestalt psychology, and the projective techniques.

The courses in the psychological foundations of teacher education taught in representative teacher training institutions were found to be in accord with these developments. The total number of courses expanded from 52 in 1900 to 431 in 1950. The eight topics offered in 1900 -- general psychology, educational psychology, the psychology of the school subjects, child psychology, character, social psychology, the teacher, and Herbartianism, had expanded to twenty-one in 1950 -- including all of the original courses except Herbartianism, and adding learning, adolescence, mental hygiene, guidance, exceptional children, the community, parent relations, personality, the group, tests and measurements, statistics, individual differences, evaluation, and the projective techniques. This expansion was accompanied by a shift in emphasis from concern with (1) intellectual attainment in the early decades of 1900 and 1910 through (2) measurement in the middle decades of 1920 and 1930 to (3) personal and social relations in the final decades of 1940 and 1950. 283 pages. $3.65. Mic 57-1299

THE RELATIONSHIP OF PERSONAL CHARACTERISTICS TO PERFORMANCE IN THE INITIAL TEACHING EXPERIENCE

(Publication No. 20,439)

Iris Marie Timson, Ed.D.
Stanford University, 1957

THE PROBLEM

This study explores the relations of certain characteristics of student teachers and teaching interns, measured or observed at the pre-teaching stage, to the behavior of these persons in their initial teaching experience.

PROCEDURE

This is an experimental study done in a field setting. It is an exploratory rather than a definitive study in that it is an intensive study of a small number of subjects over an extended period of time rather than an extensive study of a large group of subjects at any given time. It is clinical in its use of individually and personally oriented data to help in developing understandings about groups of individuals in particular situations. Questions were formulated which sought relationships between antecedents of teaching behavior and the teaching behaviors (consequents).

The subjects of the investigation, twenty-nine student teachers and four teaching interns, were all of the graduate students (1955-56) returning to Stanford University to complete the elementary credential program leading to the Master of Arts degree. These students are highly selected and probably representative of the top proportion of scholastic aptitude in teacher training candidates.

The data were gathered during the last two years of the five-year elementary credential program. Data on pre-teaching characteristics were obtained on academic achievement, attitudes toward children, empathy, social acceptance, attitudes toward teaching, and confidence. Data on student teaching behavior were gathered from outside observer reports, students' self reports, and resident teacher and supervisor reports.

ANALYSIS OF THE DATA

Means of all the measures were computed and the subjects were placed in rank order on all measures. Scatter-diagrams of the antecedent characteristics and the consequent behaviors were made and product-moment coefficients of correlation were computed. Since the focus of this study is to find leads toward relationships, the 10 per cent level of confidence was taken as indicating a relationship worth further study. When it was not possible to compute correlations because of the small N, as in the case of the interns and matched student teachers, the data were used in clinical descriptions of the subjects.

SUMMARY OF FINDINGS

The relations found for the whole group (student teachers and interns, N = 33) which were significant at better than the 10 per cent level of confidence were as follows:

Consequent	Consequent	Correlation
Self-reported Feelings of Confidence during teaching	Self-reported Feelings of Success in teaching	.4720
Professional courses - grade point average	Observer report of teaching behavior	.4762
Total grade point average	Observer report of teaching behavior	.3441
Empathy	Observer report of teaching behavior	.3154
Professional courses - grade point average	Self-reported Feelings of Success in teaching	.3432
Total grade point average	Self-reported Feelings of Success in teaching	.3999
Pre-professional courses - grade point average	Self-reported Feelings of Confidence during teaching	.3117
Antecedent	**Antecedent**	**Correlation**
Total grade point average	Minnesota Teacher Attitude Inventory	.4015

CONCLUSIONS

In this highly able group, achievement as measured by grades, particularly in professional courses, was found to be the best predictor of teaching behavior. Empathy showed a significant relationship to observed behavior and should be of use in predicting teacher behavior or as a criterion of selection in teacher education. The Minnesota Teacher Attitude Inventory did not relate to observed behavior, but within the student teacher group, did show a relationship to self-reported feelings of success.

This experimental research was designed to examine the relationships of variables in a relatively naturalistic situation. Because the sample was small and homogeneous, the relationships found cannot be taken as definitive but suggest hypotheses for further research.

169 pages. $2.25. Mic 57-1300

EDUCATION, THEORY AND PRACTICE

AN ANALYSIS OF THE CLASSROOM ACTIVITIES OF OKLAHOMA PRIMARY TEACHERS FOR THE SCHOOL YEAR 1951-1952

(Publication No. 19,483)

Elton Amburn, Ed.D.
The University of Oklahoma, 1956

Major Professor: Dr. F. F. Gaither

This study is concerned with surveying and analysing the existing practices relative to classroom activities, as currently performed by Oklahoma Primary Teachers.

To compile data for this study, a questionnaire was constructed containing one hundred eighteen classroom activities which were classified into seven divisions. All respondents to the questionnaire were Oklahoma teachers of Grades One, Two, and Three.

The following findings are based on the responses of these Primary Teachers:

1. The reported response of the Oklahoma teachers in Grades One, Two, and Three reveals that they have a duty and/or responsibility for performing a majority of the classroom activities listed in the survey instrument for the school year 1951-1952. The teachers of Grade One report the performance of ninety-eight, or 83 per cent, of the listed classroom activities; the teachers of Grade Two report ninety, or 76 per cent; the teachers of Grade Three report ninety-six, or 81 per cent; and the primary teachers as a group report ninety-eight, or 83 per cent.

2. The primary teachers perform a greater number of the listed classroom activities "daily" than any other reported frequency of performance. The teachers of Grade One report the daily performance of thirty-eight, or 32.2 per cent, of the one hundred eighteen classroom activities; the teachers of Grade Two report forty-two, or 35.6 per cent; the teachers of Grade Three report thirty-seven, or 31.4 per cent; and the primary teachers as a group report forty-one, or 34.7 per cent.

3. Teachers in Grades One and Two reported performances most nearly alike, and teachers of Grades One and Three reported performances least alike. The teachers of Grades One and Two disagreed in the performance of only ten of the one hundred eighteen classroom activities; the teachers of Grades Two and Three disagreed in eleven; and the teachers of Grades One and Three disagreed in the performance of twelve classroom activities.

4. The Oklahoma Teachers in Grades One, Two, and Three rated a greater number of the one hundred eighteen classroom activities to be "of greatest importance" in contributing to pupil achievement than any other ratings given. The teachers of Grade One rated fifty-four, or 45.8 per cent of the classroom activities to be of greatest importance, the teachers of Grade Two rated forty-one, or 34.7 per cent; the teachers of Grade Three rated forty-three, or 36.4 per cent of the classroom activities to be of greatest importance as a contribution to pupil achievement.

5. In activities involved in planning and assigning, the selection of slides for instructional purposes was suggested by twenty-six respondents. This activity should be added to the original list of classroom activities in the questionnaire used. 232 pages. $3.00. Mic 57-1301

THE EFFECTS OF MULTIPLE INSTRUCTION UPON LEARNING IN COLLEGE PHYSICS

(Publication No. 20,272)

Ralph H. Blumenthal, Ph.D.
New York University, 1956

Chairman: Professor Cyrus W. Barnes

The purpose of this study was to investigate and predict end-term achievement of students in college physics who have attended split sections of lecture, recitation, and/or laboratory with those who have not. In order to facilitate the solution of this major problem, the following subordinate problems were investigated: to contrast the acquisition of physics knowledge of students who have attended split sections of elementary physics with those who have not; to contrast the acquisition of physics problem-solving abilities of students who have attended split sections of elementary physics with those who have not; and to relate end-term success, measured in terms of physics knowledge and physics problem-solving abilities, to ability to reason, general scientific knowledge, and mathematics ability determined at the time of college entrance, for those who have and those who have not attended split sections of elementary physics. The term "split section" as used herein refers to a physics class with more than one instructor for its component parts. Thus a split section of lecture and recitation hours refers to a physics class which is lectured to by an instructor other than the recitation instructor. A section may be split two ways, in which case the lecture, recitation, and laboratory instructors are different. The term "physics problem-solving abilities" as used herein refers to success in solving problems in physics involving the use of mathematics. In the course of analysis, the third subordinate problem was generalized to include all students, whether or not they attended split sections. The course used for survey purposes is General Physics I, the firat half of a year course in traditional college physics, designed primarily for science majors, offered in the Day Session of Brooklyn College, a municipal liberal arts college of the City of New York. Classes in General Physics meet six hours per week for fifteen weeks of each semester; two hours per week each for lecture, recitation, and laboratory. General Physics I comprises topics in mechanics, heat, and sound. The physics final examination at Brooklyn College consists of two parts, the first concerned with physics knowledge and the second concerned with physics problem-solving. Entrance examination scores and standard scores for both halves of the final examination were analyzed for 173 students who took Physics I during the Spring-1953, Fall-1953, and Spring-1954 semesters using analysis of variance and multiple regression techniques. The following generalizations may be stated for the physics course of the type offered at Brooklyn College: physics students whose lecturers are the same as their recitation instructors show greater achievement in terms of end-term physics knowledge than students whose lecture and recitation instructors are not the same; there is no significant difference in achievement in terms of end-term physics knowledge between groups who have the same or different instructors in recitation and laboratory; in terms of end-term physics problem-solving abilities, there are no significant differences in achievement for students who do and do not attend split sections; students who display a good general scientific knowledge at the time of college entrance generally have a greater factual knowledge of physics at the end of the first course in physics than those who do not; students who display ability in mathematics, and to a lesser extent a good general scientific knowledge at the time of college entrance generally show greater achievement in terms of physics problem-solving abilities at the close of the semester than those who do not; ability to reason is not significantly related either to end-term physics knowledge or physics problem-solving abilities.

170 pages. $2.25. Mic 57-1302

A COURSE OF STUDY FOR ENTRANCE PRODUCTION WORKERS IN THE RADIO MANUFACTURING INDUSTRY

(Publication No. 17,651)

Harold Kaplan, Ed.D.
New York University, 1956

The purpose of the investigation was to develop a course of study for training entrance production workers in the radio manufacturing industry. To develop the course, the investigator first determined the need for this type of course, then identified entrance production jobs, conducted job analyses of these jobs to reveal trade and technical information required for success in these jobs, and finally developed the course. Content for the course was taken from industrial information and situations to help the learners make the transition from the environment of the school shop to that of industry.

Various research techniques were employed to establish data. The techniques included the use of questionnaires, library research, interviews, checklists and follow-up visits to industrial plants and the use of juries of experts.

The need for the course was established by the responses to questionnaires sent to radio manufacturers and vocational-industrial educators, and readings in the field.

Entrance production jobs were identified and described through data in the Dictionary of Occupational Classifications, the Dictionary of Occupational Titles, and the investigator's knowledge of the field. Data were verified by replies to questionnaires sent to educators, industrial personnel, and members of labor organizations, and follow-up visits to radio manufacturing plants. From these sources, the investigator compiled information concerning 23 basic entrance production jobs.

Because of the nature of the area under study, the most practical tool for course construction is the job analysis. Because there seemed to be no agreement in the field as to a common method of trade and job analysis, the investigator examined many methods suggested by authorities in the field and developed a composite method suitable for the purposes of the investigation.

Using as a starting point the information obtained during the processes of describing and verifying the entrance jobs, and adding to these data, additional data obtained during visits to manufacturers, the investigator performed the job analyses for the jobs previously identified. The information in the job analyses was verified by the opinions of members of juries of qualified teachers of radio, and qualified radio production engineers.

The data contained in the job analyses were divided into two areas, trade information and trade or manipulative skills. Materials in the course of study were similarly divided into theory and shop work. Materials for the shop work were divided into two areas, training in basic techniques through the use of job sheets, and training in production line techniques through the use of operation sheets. The information in the job sheets includes related technical information as well as information necessary for training in the manual skills.

Because the course can be administered to diverse groups, each with different educational goals, lesson plans for the related technical information were not included. However, the investigator has indicated the area and the level of learning for each topic to guide the teacher in developing a lesson plan.

The method of course construction that was used in the investigation is not a complete method, in that no provisions for tryout and revision were incorporated. This is not a deficiency. These steps were omitted because they did not fall within the scope of the investigation.

Although the investigator recognizes that the school shop is not an industrial shop, and the assembly line is not a typical school situation, certain aspects of production line techniques can be applied in a school situation. These aspects were included in the course to aid the learner to become more familiar with industrial techniques, practices and conditions. 412 pages. $5.25. Mic 57-1303

A PLAN FOR THE IMPROVEMENT OF A SECONDARY SCHOOL PROGRAM BASED ON AN ANALYSIS OF CERTAIN PROBLEMS OF PUPILS AS REVEALED BY THE MOONEY PROBLEM CHECK LIST

(Publication No. 20,289)

Laurence Gilbert Paquin, Ed.D.
New York University, 1956

At the present time there is virtually unanimous agreement among curriculum workers with the principle which states that youth-needs must be one of the bases for the modern school program. Acceptance of this principle means that a school staff must find some systematic and reliable procedure for discovering the problems and interests of the pupils. This study describes how a school staff applied this principle in an actual school situation--a school situation involving a professional staff of 158 and nearly 2300 junior and senior high school pupils.

The first task of the group responsible for leadership in the project was the development of staff understanding and support. This was accomplished through a series of discussions involving the different school faculties, the regular curriculum improvement organization, and the guidance staff.

The coordinating committee also worked out the procedures to be followed in the administration and tabulation of the results. Except for the all-important matter of rapport between the administering teachers and the pupils, the problem was essentially one of mechanics.

The data acquired from the local survey were verified in three ways: first, by a series of personal interviews with a cross sectional group of the pupils who had filled out the check list; second, by administering the check list to an adolescent group in a summer camp; and third, by a re-giving of the check list to a sample of the original group after a lapse of ten months.

The most important aspect of the project was the use of the data by teachers, parents, and others in the improvement of the school program. This was done initially in a lay-staff conference and later, in building and departmental meetings. Out of these discussions came an action program for the improvement of the local secondary schools. The following are illustrative:

1. We need to re-examine our policies and procedures regarding homework.
2. We need to join forces with pupils and parents to work out mutually acceptable standards of behavior.

3. We need to give more attention to the importance of motivation in the learning process and so conduct our classes that pupils will want to learn.

4. We need to discover more effective ways of teaching pupils good study habits and skills.

The principle conclusions reached as a result of the study are as follows:

1. The Mooney Problem Check List is a satisfactory instrument for use in a survey of the personal-social problems of youth--provided it is administered with skill and understanding and the results studied with a clear recognition of the fact that they reveal at best only "clusters of associated problems." Such "clusters," however, are valid for use as one of the bases for curriculum development.

2. A group undertaking such as this survey has many values. Some of the values which accrued from this project were as follows:

   a. The entire staff had more valid data on the personal-social needs of local youth.

   b. The survey exposed the many pressures home and school frequently place on adolescents.

   c. The survey opened up new avenues for lay-staff cooperation.

   d. The survey caused many teachers to engage in some personal analysis--always a beneficial experience.

   e. The survey reinforced the need for guidance services.

   f. The survey proved to be an effective piece of public relations.

   g. The survey fostered a spirit of unity and cooperation on the part of the school staff.

171 pages. $2.25. Mic 57-1304

THE FUNCTIONS OF DEPARTMENTS OFFERING DOCTORAL PREPARATION IN SCHOOL HEALTH EDUCATION

(Publication No. 20,437)

Louis John Peterson, Ed.D.
Stanford University, 1957

The functions of university school health education programs are examined in this study with attention to their history, their present status, and their proposed development for the purpose of determining those that need to be stressed in programs of doctoral-level work.

The history of school health education shows evidence that today the profession has advanced to the point where evaluation and accreditation, though meeting bulwarks of resistance, are coming into their own; it offers little information, however, on the functions performed in doctoral-level programs.

The responses to letters of inquiry, sent to directors of programs offering doctoral training, and current literature discloses the functions presently performed.

On the assumption that educational structures exist to perform functions, the writer discusses functions in relationship to the structures and other characteristics (purposes, personnel, clientele, and governance) which are common to all social institutions. Further, he indicates the inconsistent application of the term "functions" and submits both a definition and an outline, adapted from Dr. W. H. Cowley's functional analysis on the overall field of higher education, as a starting point from which to categorize them. "Functions" are considered to be the characteristic activities of a structure; they are always expressed as gerunds. The outline follows:

Raison d'Etre Functions:

- Education Function
- Research Function

Auxiliary Functions:

- Conservation Function
- Selection Function
- Social-Criticism Function
- Forum Function
- Honorific Function
- Haven Function

Self-Continuity Functions:

- Policy Control Function
- Operational Control Function
- Facilitation Functions
  - Money-Centered Functions
  - Materiel-Centered Functions
  - Clientele-Centered Functions
  - Personnel-Centered Functions
  - Record-Centered Functions
  - Public-Centered Functions
  - Ceremony-Centered Functions
- Developmental Functions
  - Program Development Function
  - Financial Development Function
  - Self-Study or Institutional Research Function

Using the Cowley classification as a guide, the writer found that the list covered all the functions performed by school health education departments despite the differences in structuring.

The information for the proposed development of the functions came from leaders in the field whose opinions were sought in interviews concerning what functions should be performed in the doctoral programs. The conclusions drawn from the opinions canvassed demonstrated that all of the functions listed by Cowley should be applied in varying degrees in the school health education programs.

Finally, the writer compares the data gathered on the history, the present status, and the proposed development of health education enterprises and from this proposes the functions that seem to need stress in the doctoral programs.

Four conclusions come from this study:

1. The doctoral programs are in a state of flux but are becoming identifiable though not necessarily separated from affiliated structures.

2. The identification of school health education as an accepted profession will come first through an agreement on the functions performed rather than through an assignment of the specialty to particular structures.

3. The list of functions presented by Cowley offers a complete, though, at times, unwieldy group by which to analyze departmental functions.

4. The Cowley classification provides a most complete framework upon which comprehensive programs of doctoral-level work in school health education can be built.

Two recommendations come from this study:

The first of these is that a list comparable to Cowley's but one which will cover the functions of the departmental level structures more specifically should be developed to facilitate the analysis of present and future functions of structures engaged in school health education.

The second recommendation is that each function on such a listing be pursued in research and practice.

197 pages. $2.60. Mic 57-1305

A MANUAL FOR THE UTILIZATION OF SOUND FILMS AND TELEVISION PROGRAMS BY COUNSELORS AND TEACHERS OF GROUP GUIDANCE IN JUNIOR HIGH SCHOOLS

(Publication No. 20,294)

Irving S. Sexter, Ed.D.
New York University, 1956

Chairman: Professor Earl R. Gabler

The Problem

This study has prepared material for a manual providing counselors and teachers of ninth year junior high school group guidance with the most effective techniques for the selection, utilization, and integration of sound films and television kinescopes with educational and vocational guidance.

The Need

The highly successful utilization of sound films and television as training tools by the Armed Services during World War II has given wide impetus to their use in education. The growth in school population, paralleled by decreasing teacher staffs, has made it imperative that educators utilize these multisensory teaching aids more extensively and more efficiently, in meeting today's educational needs.

In addition to indicating effective film utilization techniques, the manual provides listings showing sources, classifications, and availability of the most widely used films and kinescopes for educational and vocational guidance in ninth year junior high school.

The Method

In order to determine the most effective techniques for film utilization, three normative-survey research testing instruments were employed:

1. An individually recorded interview with consultants of the five largest educational film producers, to ascertain recommended utilization techniques, effective related materials, sound films and kinescopes in greatest demand, and an indication of their future plans in film and kinescope production for group guidance.

2. A questionnaire to state and city audio-visual directors elicited titles in greatest demand and most effective techniques in film and kinescope selection and utilization for group guidance.

3. A documentary frequency study of fifteen representative and widely used discourses containing viable suggestions for the selection and utilization of sound films. In a manner similar to that employed in listing the data from the questionnaire on effective film utilization techniques, all suggested techniques obtained from the documentary frequency study were included in one of the following areas: "Selection and Evaluation of Films," "Teacher and Pupil Preparation," "Presentation of Films," "Post-Presentation Activities," and "Teacher and Pupil Evaluation of Film Utilization."

Finally, these film utilization techniques were analysed in terms of their integration with the particular needs and problems of pupils and teachers in group guidance classes.

Findings and Recommendations

As a result of this study to develop a manual for film utilization in group guidance, the following findings and recommendations were made:

1. The teacher should decide when to use a film in a group guidance unit only after careful consideration of such factors as pupil needs and interests, film content and organization, the degree of unit development, unit aims and objectives, and concepts and facts to be emphasized.

2. An audio-visual reference room should be established in each school, to contain producers' film study guides, teacher evaluation records, and such additional film evaluation material as the Educational Film Catalogue, the EFLA Film Evaluations, and several audio-visual periodicals.

3. Since the study has strongly indicated the need for a manual showing the most effective techniques for film utilization, each teacher should receive a manual similar to the one provided for in this study.

4. Administrators and supervisors should take audio-visual techniques courses, enlist cooperation of boards of education and legislative bodies in promoting film utilization, and work actively in organizations promoting audio-visual education.

5. Guidance personnel and administrators should make evident to film producers the need for job-focused vocational guidance films.

6. A program of in-service teacher training in film utilization, including the use of training films and producers' consultants, should be established in each school or district.

7. School architects should include adequate classroom areas for the most effective utilization of audio-visual aids.

8. The program of film utilization in group guidance should be regularly evaluated to insure continuous effectiveness.

9. Teachers meeting audio-visual certificate requirements should be given higher status with accompanying salary adjustments. 214 pages. $2.80. Mic 57-1306

A STUDY OF HOMEROOM PRACTICES IN NINE SECONDARY SCHOOLS IN TENNESSEE

(Publication No. 20,500)

Everett Theodore Watrous, Ed.D.
The University of Tennessee, 1956

Major Professor: Earl M. Ramer

The nine senior public high schools which participated in this study were made up of a large, a medium, and a small sized school chosen from each of the three divisions of the State of Tennessee. A school with an enrollment of less than two hundred was classified as small; while an enrollment which fell between 200 and 599 was considered medium, and those with enrollments of 600 or above were designated large. The spread of the enrollments was between ninety-three and 900. The number of people on the teaching staffs ranged from five to thirty-two. The number of homerooms per school was from four to thirty. In the nine schools the homeroom system had been used for varying lengths of time; the shortest of which was one year; the longest was fifteen years.

The participants in the study were 290 students, fifty-seven homeroom sponsors, and nine administrators. Ninety of the students were Seniors, seventy-six were Juniors, fifty-four were Sophomores, and seventy were Freshmen. The large majority were between fourteen and eighteen years of age. Of the 290 students, 127 were boys and 163 were girls.

The fifty-seven sponsors represented every teaching area of the secondary school. This could not be otherwise since nearly seventy-seven per cent of the teaching personnel are called upon to serve as homeroom sponsors. Most of these homeroom teachers were experienced workers. Only 17.5 per cent had fewer than six years teaching experience. However, in homeroom work they represented less experience. Over half, or 52.6 per cent, had fewer than six years homeroom experience.

Three kinds of instruments were developed to help with the data gathering. The first and second were interview guides for use with administrators and sponsors. The third was a questionnaire for students. In the first two instances the writer asked the questions contained in the interview guides and recorded the answers on a copy of the guide, one of which was used for each person consulted. The student questionnaires were presented by the investigator to groups of five students drawn from the homerooms of participating sponsors. The sample groups met the writer privately and after completing the questionnaires they were engaged in conversation. At this time an effort was made to secure the students' informal oral evaluation of the homeroom program as it was carried on in their particular school.

What seem to be the most pertinent findings of the study are listed as follows:

1. Homeroom practices in Tennessee were found to be much like those reported to exist in other states.
2. Very few sponsors were specifically prepared for homeroom work either through pre-service or through in-service education.
3. In most cases the school staffs had not definitely clarified the purposes of the homeroom program.
4. The coordination of the homeroom activities with the rest of the curriculum was for the most part incidental.
5. In some places, but not all, the homeroom period suffers because of frequent interruptions. Other activities, which appear for the moment to be more important, supplant the scheduled homeroom meeting.
6. Through their activities including programs and discussions the students find in the homerooms a laboratory for democratic leadership and followership.
7. Homerooms were making only limited use of audio-visual materials on the subject of guidance.
8. Homeroom sponsors fill a major role in educational and personal guidance; however, they seem to hold a lesser position in vocational guidance.
9. In general homerooms had been subjected to only informal evaluation.
10. A large percentage of sponsors felt that the homerooms were a good potential guidance agency but that at present they were not achieving their possibilities.

217 pages. $2.85. Mic 57-1307

ENGINEERING, AGRICULTURAL

METHODS FOR EVALUATING IMPORTANT FACTORS AFFECTING SELECTION AND TOTAL OPERATING COSTS OF FARM MACHINERY

(Publication No. 20,211)

George Herbert Larson, Ph.D.
Michigan State University, 1955

Mechanization of agriculture is requiring a relatively large capital investment in equipment. For 1953, records of 501 farms in the state of Michigan showed that the total capital investment per farm not including house averaged $33,385, with the investment in machinery and equipment amounting to $7461 per farm, or 22.4 percent of the total farm capital. Moreover, machinery investment has increased approximately 62 percent from 1949 to 1954.

With the rapid development of new farm machines the farm manager is faced with the problem of making adjustments which require cost prediction. One of the problems that needs further study is the development of some simple method for estimating costs of operating machinery that could be used by a person of non-technical background, say a farm equipment dealer, farm operator, or perhaps extension workers.

A set of alignment charts or nomographs has been developed for making machinery operating cost estimates; and tables have been prepared which are an aid to using the alignment charts.

Another problem which is in need of investigation is a method for determining when a machine is no longer economical to operate and should be replaced by a new machine. One of the important factors affecting the point beyond which a machine is no longer economical to operate is cost of repairs. Review of literature indicated that there is a very limited amount of data on how repair costs vary with use. This factor alone limited the amount of work that could be done to develop a feasible method for determining when a machine is no longer economical to operate.

The research work reported in the thesis was approached first by a review of existing literature and by obtaining published material in the form of bulletins, circulars, mimeographed material and personal correspondence relative to farm equipment costs. This information was needed as background material for developing mathematical relationships and preparing alignment charts for estimating operating costs of farm equipment.

The above program was partially accomplished by writing to the heads of departments of agricultural engineering at colleges and universities in the United States and by consulting commercial agencies associated with farm equipment.

A survey in person was made of the cost records for tractors operated at Seabrook Farms, Bridgeton, New Jersey. Machinery cost records obtained from J. I. Case Company and Green Giant Company were examined. Also cost records, received from Professor Bateman, agricultural engineering department at the University of Illinois, were analyzed.

The investigation confirms that one of the major factors affecting total operating cost of farm machinery, is depreciation which is considered to be a fixed or ownership cost. It appears that the declining-balance method of depreciation as suggested by tax legislation for income tax purposes might also be used for estimating cost of depreciation for farm machinery when the exact amount is not known since it tends to give a more realistic value than the straight-line method.

Some of the simple nomographs or alignment charts constructed were tried out in a farm machinery class. The results indicate that the charts will perhaps have some practical application by farm equipment personnel, extension workers and farm operators. Enthusiasm expressed by a representative of one of the major farm equipment companies indicates that the charts have some merit.

Results of a study of repair cost data on seven tractors for a period of ten years indicate annual repair costs increase at an increasing rate according to the relationship, $Y = 0.314X^{1.61}$ where Y is repair cost in percent of new cost and X is the year in question. This relationship is based on an average annual use of 550 hours per year.

For the group of tractors analyzed it appears that they should be replaced at the ninth or tenth year based on the proposed method for determining when a tractor is no longer economical to operate.

For the same group of tractors studied, it was observed that a three year old tractor would provide the lowest average annual operating cost due to the high rate of depreciation during the first two years of use.

It is believed that more detailed information is needed on the relationship between repair cost and use to adequately evaluate the factors influencing operating costs of various farm machines. Past performance data of certain farm machines is probably the best source of information for predicting behavior of future machines.

113 pages. $2.00. Mic 57-1308

ENGINEERING, AERONAUTICAL

TURBULENT SHEARING STRESS IN THE BOUNDARY LAYER OF YAWED FLAT PLATES

(Publication No. 20,404)

Harry Israel Ashkenas, Ph.D.
Cornell University, 1956

Hot-wire anemometer measurements of the turbulent shearing stress in a turbulent boundary layer on a yawed flat plate are presented. Two plates with angles of yaw of 0° and 45° were studied. Transition of the boundary layer

was accelerated by the use of a 1″ strip of sandpaper attached to the leading edges of the plates. Mean velocity measurements of the boundary layer velocity profile at several stations on each plate were made using pitot tubes and conventional techniques. Measurements of the intensity of turbulence were made simultaneously with the turbulent shear measurements by means of hot-wire X-meters, using a technique developed by the author. The experimental procedure is reviewed briefly, and an attempt is made to evaluate the precision of the results.

The measured velocity profiles are approximated using the law of the wall and law of the wake; the resulting analytic expression for the velocity profile is used, together with the boundary layer equations of motion to calculate the distribution of shearing stress through the boundary layer. The calculated shearing stress distributions are compared with the experimental measurements.

The unyawed flat plate data agree well with the calculated shear distribution, whereas the 45^0 data are apparently not amenable to calculation. It is shown, however, that the calculated shear distribution is relatively insensitive to the form of the velocity profile assumed. Some speculative remarks are included in an attempt to explain the discrepancy. 69 pages. $2.00. Mic 57-1309

CIRCULAR CYLINDRICAL SHELLS UNDER CIRCUMFERENTIAL LINE LOADS

(Publication No. 18,355)

James Sheng, Ph.D.
Polytechnic Institute of Brooklyn, 1956

Equations for the deflections of and the stresses in thin-walled circular cylindrical shells simply supported at their ends and under segmental circumferential line loads are determined. The loads considered consisted of a uniformly distributed segmental radial load yielding a resultant radial force at the center of a generator, a piece-wise uniformly distributed radial load statically equivalent to a concentrated circumferential moment at the center of a generator, and a uniformly distributed longitudinal moment statically equivalent to a concentrated axial moment at the center of a generator. Practical applications of the solutions given are indicated for solutions of problems involving loadings other than those specifically treated.

Donnell's basic differential equations and Hoff's method of solution are used. Closed form expressions are given for the deflections, membrane, and bending stresses for the radial load case. For this case a numerical example is presented for a radius-thickness ratio of 50, a radius-length ratio of 1/5, and for a loaded length equal to 1/20 of the circumference.

Comparison of the solutions of the radial line-load case with those corresponding to a line load along a segment of a generator of a corresponding cylinder is made. The numerical results, considered in the light of earlier solutions, show that the present solutions are adequate for the direct estimation of deflections and membrane stresses due to localized surface loads. However, the bending stresses in the neighborhood of such loads must be obtained by first representing the surface load by a statically equivalent set of line loads and then superposing the results obtained from each of the line load solutions.
80 pages. $2.00. Mic 57-1310

ENGINEERING, CHEMICAL

RATE-CONTROLLING MECHANISMS IN THE CORROSION OF SINGLE CRYSTALS OF ZINC IN AQUEOUS SOLUTIONS

(Publication No. 20,368)

Indra Kumar Arora, Ph.D.
University of Washington, 1956

In order to obtain corrosion-rate data from which the rate-controlling mechanisms could be determined, corrosion studies were carried out on single crystals. Single crystals of zinc were used because of the uniform surfaces available on the crystal planes.

Zinc specimens exposing the (001) and the (100) planes were obtained from crystals grown from a zinc melt. The method of growing single crystals used in this study consisted essentially of cooling the melt in a controlled temperature gradient. Crystal specimens with crystallographic axes within 10^0 of the vertical axes of the specimens were obtained. The (001) plane was obtained by cleaving, and the (100) plane by machining, and both surfaces were subsequently chemically polished.

The corrosion-rate results of single and polycrystalline specimens were obtained by rotating the specimens at a constant speed in deaerated hydrochloric acid, acetic acid, and sodium hydroxide solutions, with and without applying external anodic currents.

In acidic solutions, without any depolarizing agent, the rates of corrosion of the two planes differed from each other by a factor of 1.7. When a depolarizer was added to the corrosive media, identical rates were obtained for the corrosion rates of the two planes in the pH range of 1.7 to 6.0, while rates differing by a factor of 0.60 were obtained in the pH range of 6.0 to 7.0. In basic solutions the rates of corrosion of the two planes differed from each other by a factor of 0.3 to 0.6 in the pH range of 10.5 to 12.5, whereas above a pH of 12.5 the rates differed by a factor of 0.75. Upon application of external anodic currents the rates of corrosion decreased in the pH range of 1.7 to 5.0, increased in the pH range of 5.0 to 12.5, and no effect was observed above a pH of 12.5. In the pH range of 6.0 to 7.0, the rates of corrosion of polycrystalline specimens were found to be higher than those of either of the two single crystal specimens.

The rates of corrosion were also calculated theoretically by a consideration of the crystal structure of zinc. The rate of evolution of hydrogen on the (100) plane was calculated to be 1.4 times that on the (001) plane, and the rate of chemical reaction on the (100) plane 0.61 times the rate on the (001) plane. The results checked within 20 % of the experimental ratios.

It was concluded that in the corrosion of zinc in acids the rate of evolution of hydrogen controls the rate of corrosion. Upon adding a depolarizer the rate of diffusion of

corrosive agent through a stagnant film controls the rate of corrosion in the pH range of 1.7 to 6.0. In the pH range of 6.0 to 12.5, the rate of chemical reaction at the surface controls, and above a pH of 12.5, both the rates of chemical reaction at the surface and diffusion through a solid layer control. 140 pages. $2.00. Mic 57-1311

THE EFFECT OF PRESSURE ON CATALYTIC CRACKING

(Publication No. 20,379)

Frederick Carl Franklin, Ph.D.
University of Washington, 1956

An apparatus has been designed and constructed to study the effect of pressures up to 600 psig on catalytic cracking in the range of commercial operating temperatures and space velocities. Operating techniques have been developed and analytical procedures have been utilized to obtain data on conversion, product weight distribution, gas composition, determination of paraffinic, olefinic, and aromatic content of the gasoline, and carbon to hydrogen ratio of the coke deposit.

A feed stock was prepared from commercial diesel oil by steam distillation, using a twenty plate laboratory rectifying column, so that a mid cutpoint was obtained. The feed used consisted of the last 50 volume per cent of the diesel oil. Although of a lower and narrower boiling range than the usual commerical charge stocks, it contained negligible gasoline and could be expected to show similar effects of pressure on cracking as would commercial charge stocks. A method was also developed to reduce the color density of the feed stock in preparation for its use in the reactor apparatus.

A method of correlating conversion and space velocity was proposed and utilized to obtain the effect of pressure on conversion at constant space velocity. The correlation assumes a monomolecular overall reaction on a single catalyst site to be the rate controlling mechanism. Due to the complex nature of the reaction, the complexity of the feed and products, and the limited data available, evaluation of the adsorption and reaction rate constants involved was not considered.

However, the correlation of conversion with pressure at constant space velocity was suggested as a practical expression of the variation of the overall rate constant with pressure. The results indicated an increase in cracking rate, as defined in this work, up to about 200 psig with the greatest increase in the first 50 psig. A greater increase was observed at 750°F than at 850°F for the first 200 psig.

The effect of increased pressure on the product distribution could be summarized as follows: (1) a great reduction in all olefins, particularly those in the gas, (2) an increase in paraffins apparently reflecting hydrogenation of some of the formerly unsaturated hydrocarbons, (3) an increase in material relatively unreactive to cracking, polymerization, and alkylation in the gas, e.g., methane, ethane, and propane, (4) an increasing tendency to form heavier fractions in the range of the feed and coke, indicating increased polymerization and alkylation relative to cracking, (5) a slight increase in the n- to i-butane ratio, (6) a general trend toward decreased gasoline yield, and (7) only slight or negligible effect on pentane production and carbon to hydrogen ratio in the coke.

On the basis of the above trends, if one considers them representative of commercial stocks, the economic evaluation indicated that the pressure operation resulted in unfavorable product distribution to such a degree that neither single pass nor recycle operation would be benefited by pressure, even if the additional cost of pressure operation and increased equipment first cost were neglected. 183 pages. $2.40. Mic 57-1312

METALLIC BORIDES AND SILICIDES BY FUSED SALT ELECTROLYSIS

(Publication No. 20,381)

Harold Thomas Fullam, Ph.D.
University of Washington, 1956

Titanium boride can be deposited electrolytically from a fused salt bath composed of potassium chloride, potassium fluoborate, and potassium fluotitanate using graphite or stainless steel cathodes and graphite crucibles which serve as the anode. The composition of the cathode deposit can be varied over a wide range by varying the melt concentrations and operating conditions, but the diboride TiB_2 is the basic component of the deposit.

Decomposition potential measurements indicate that the deposition of the boride occurs through the combination of two cathode reactions; 1. electrolytic reduction of the titanium ion which is formed by a series of reactions involving the fluotitanate ions, and 2. the chemical reduction of the fluoborate ion by metallic potassium which is deposited electrically at the cathode. The titanium and boron thus formed react to form the boride. These reactions are given by the following equations.

$$Ti^{+4} + 4\,e \rightarrow Ti$$
$$6K^{+} + 6\,e \rightarrow 6\,K$$
$$2\,KBF_4 + 6\,K \rightarrow 2\,B + 8\,KF$$
$$Ti + 2\,B \rightarrow TiB_2$$

As can be seen from the equations ten equivalents of electricity is required to produce one molecular weight of the diboride.

Normally the boride is obtained as a granular deposit containing large amounts of occluded salts but under certain conditions a thin, extremely hard, and adherent deposit can be obtained on a stainless steel cathode.

Titanium silicide can be produced by a similar process by substituting potassium fluosilicate for the potassium fluoborate. The monosilicide TiSi is the basic product and there is little change in the composition of the deposit as the melt composition and operating conditions are varied.

Zirconium boride, zirconium silicide, molybdenum silicide and chromium boride can be prepared in a similar manner by using the appropriate fluocompounds.

199 pages. $2.60. Mic 57-1313

MASS TRANSFER IN RIPPLING AND TURBULENT FALLING LIQUID LAYERS

(Publication No. 20,767)

John Nick Goulias, Sc.D.
Washington University, 1956

Adviser: Professor W. P. Armstrong

Absorption of carbon dioxide by falling water layers was measured in a one inch diameter, glass wetted wall column aligned vertically.

Five variables were measured and controlled.

1.) The partial pressure of carbon dioxide was held practically constant (range 31.7 to 32.1 inches mercury).
2.) The temperature was maintained close to 35° C (range 34.5 to 35.2° C).
3.) Eight water flow rates were employed ranging from corresponding Reynolds numbers of 400 in the rippling streamline flow range to 4160 in the turbulent flow region.
4.) Carbon dioxide flow rates were varied at each of the eight water rates observed, at essentially constant temperatures and pressures. The actual gas flow rate ranged from 43 to 634 cc/min (measured at 70°F and 14.7 psia).
5.) Lengths of falling water layers were observed from 1.9 to 36.8 inches, and were dependent upon the values of the four independent variables just presented.

The data were interpreted in terms of two dimensionless parameters, the point efficiency and penetration parameter, chosen for their ability to generalize a large number of variables, and to compare the data with the theoretical absorption models. A wide range of the parameters was studied; the point efficiency varying from 0.018 to 0.710, and the penetration parameter based on molecular diffusion varying from 0.00023 to 0.127. The reproducibility of the data was excellent since the correlation coefficients (between functions of the point efficiency and the molecular diffusion penetration parameter) were all greater than 0.98.

Upon comparing the data with the theoretical absorption equations, five distinct regions of absorption behavior were determined. One region followed molecular diffusion theory while the other four regions exhibited point efficiencies considerably higher than theoretical molecular diffusion values because of eddy motion attributed to rippling and turbulence. The point efficiencies for the maximum observed falling water length of about 36 inches were from 1.4 (N_{Re} = 400) to 3.3 (N_{Re} = 4160) times the molecular diffusion values.

The large discrepancies between observations and theories were further interpreted in terms of apparent eddy diffusivities. Corresponding total mass transfer rates in rippling streamline flow were from 2.1 (N_{Re} = 400) to 6.1 (N_{Re} = 2120) times the molecular rate. Turbulent flow range effects were even more important; the total mass transfer rates reaching values 12 to 47 times the molecular rate when N_{Re} = 4160. Apparently the highest rate increase occurred in the turbulent flow absorption region during development of the turbulent velocity profile.

Attempts were made to increase absorption rates by subjecting the carbon dioxide water interface to electrical fields imposed between a charged insulated rod in the gas phase and the grounded water layer. Direct current voltages were applied ranging from 0.40 volts up to the gas phase breakdown voltage of 8,000-10,000 volts. Similarly, alternating current voltages were employed in the range of 45 to 8,800 volts at breakdown. No increase in absoprtion rates was noticed when electrical fields were utilized.

171 pages. $2.25. Mic 57-1314

THE ABSORPTION OF CARBON DIOXIDE INTO AQUEOUS MONOETHANOLAMINE SOLUTIONS

(Publication No. 20,498)

Robert E. Griffith, Ph.D.
The University of Tennessee, 1956

Major Professor: F. N. Peebles

This document constitutes a report on an effort to obtain a mathematical description of the fundamental mechanism by which CO_2 is absorbed in monoethanolamine and its aqueous solutions through the employment of transient state, constant gas volume manometric measurements. In the primary objective of definition of a transfer mechanism and application of this result to the absorption of CO_2 from single bubbles rising through shallow liquids the investigation was unsuccessful. There are however several observable physical results as well as certain special experimental conclusions which are of interest.

The specific rate of CO_2 absorption was found to increase both with total pressure of CO_2, in pure gas absorption, and partial pressure of CO_2 in mixed gas contacting. These effects are much more pronounced for shorter times of contact. It was noted that a local maximum rate of absoprtion occurs between 5.0 and 7.5 normality as the concentration of monoethanolamine is increased but that much higher rates could be observed if the gas were contacted with pure monoethanolamine. The effect of contact time on rate of absorption is very pronounced for short times of contact but apparently disappears, for all solutions tested except pure monoethanolamine an apparent constant rate period exists over a wide range of CO_2 pressure decrease. This constant rate can be reproduced by introducing CO_2 to bring the pressure back to the range of first observance.

The manometric experiments covered a range of CO_2 pressures, both as pure CO_2 and as partial pressure of CO_2 in air, from 200 to 1200 mm Hg over monoethanolamine solutions in concentrations from 1.0 normal to pure monoethanolamine.

In absorbing pure CO_2 in pure monoethanolamine it was found that the absorption, over a wide range of CO_2 pressure, behaved as a simple first order process, i.e.,

$$\frac{dP}{dt} = kP$$

in which P represents the partial pressure of CO_2 at the interface, t the time of contact of gas and liquid phases and k a kinetic parameter. This observation, combined with some simple surface tension measurements has led to the conclusion that there is an interfacial phenomenon which is dependent on time of contact of liquid and gas

and must be accounted for in formulation of a fundamental transfer mechanism for this system.

217 pages. $2.85. Mic 57-1315

THERMOGRAVIMETRIC STUDY OF CALCIUM CARBONATE DECOMPOSITION (PARTS I-III)

(Publication No. 18,700)

Edmond Preston Hyatt, Ph.D.
University of Utah, 1956

Chairman: Dr. Carl J. Christensen

An apparatus for making rapid thermogravimetric analysis was constructed from readily assembled standard parts. A chainweight balance with optical lever was adapted so the light beam registered on either of two photocells depending upon the direction of unbalance. Current from the photocells was amplified and used to drive a small reversing motor which added or subtracted chain on the balance as required. The motor drive also turned a linear potentiometer which drove an electronic strip chart recorder. A sample of thermally reactive material was suspended from one pan of the balance into an electrically heated tube furnace. The magnitude of the weight loss (or gain) occurring in the sample during the reaction is recorded instantaneously by the electronic recorder.

The above apparatus was used to follow the decomposition of calcium carbonate crystals under carefully controlled temperature and atmospheric conditions. The rate of decomposition as derived from experimental evidence and kinetic considerations is given by the following expression,

$$\text{Rate} = \frac{1 - \frac{P_{CO_2}}{P^0_{CO_2}}}{BP_{CO_2} + \frac{1}{R_0}}$$

where the rate is given in weight loss per unit of area per unit of time; P_{CO_2} and $P^0_{CO_2}$ are the measured and equilibrium pressures of CO_2, respectively; R_0 is the rate of weight loss in nitrogen atmosphere; B is temperature dependent and is experimentally determined.

The mechanism of the decomposition is pictured as being a two-stage phenomenon. Initially the CO_2 leaves the $CaCO_3$ cell and the residue of CaO apparently assumes a metastable rhombohedral configuration similar to the original $CaCO_3$. The second step of the reaction is the formation of well-crystallized CaO from the active CaO. The active CaO thus acts as a bridge for this reversible reaction.

Another set of experiments using the same apparatus as the above shows the effect of water vapor on the decomposition of calcium carbonate both in the presence and in the absence of CO_2.

The rate of decomposition for these cases is expressed by the equation which follows, where A, like B, is a temperature dependent experimentally determined value and P_{H_2O} is the pressure of water vapor. The water vapor serves as a catalyst to assist in the removal of CO_2 from the $CaCO_3$.

$$\text{Rate} = \frac{1 + AP_{H_2O} - \frac{P_{CO_2}}{P^0_{CO_2}}}{BP_{CO_2} + \frac{1}{R_0}}$$

The Eyring absolute rate theory is brought in to play in an attempt to explain the significance of the data in view of the above kinetic expression. Enthalpies of activation and entropies of activation are estimated from the experimental data and their values add credence to the discussion. It is calculated that somewhat less than one in 20,000 of the molecular sites is responsible for the decomposition reaction and its observed rate.

88 pages. $2.00. Mic 57-1316

ENGINEERING, ELECTRICAL

A TRAVELING-WAVE TUBE USING COUPLED COAXIAL CAVITIES

(Publication No. 20,442)

Bernard Arfin, Ph.D.
Stanford University, 1957

This report describes a study directed toward obtaining a traveling-wave tube capable of power outputs well beyond the range of helix structures. A modified interdigital structure, first suggested by M. Hines of Bell Telephone Laboratories, operating in a space-harmonic region was investigated. The advantages of this structure as compared to a conventional interdigital circuit are shown.

An equivalent circuit of the structure was found to be very useful in understanding the bandpass and impedance characteristics of the structure. The Brillouin diagram of the structure and of the equivalent circuit showed fairly good agreement with each other.

The impedance of the structure was found by means of a bead perturbation method. From the impedance, the gain parameter C and the gain curves of the tube were calculated.

An X-band traveling-wave tube having a power output of three kilowatts and a bandwidth greater than 20 percent was built and tested. The calculated gains were compared to the experimental gains and were found to agree fairly well. Although the tube was tested with microsecond pulses, the structure was suitable for operation at a high duty cycle. The saturation efficiency, depending on the bean voltage, varied from about 8.5 to 12.5 percent. At any particular voltage, the saturation power remained almost constant over a considerable frequency range.

99 pages. $2.00. Mic 57-1317

ELECTRON DENSITIES OF THE IONOSPHERE UTILIZING HIGH-ALTITUDE ROCKETS

(Publication No. 18,709)

Doran J. Baker, Ph.D.
University of Utah, 1956

Chairman: Obed C. Haycock

The problem of determining the electron densities in the E-region of the ionosphere is attacked by using 6-Mc pulse transmissions from a rocket to several ground receiving stations.

A logical and complete development, using dyadic techniques, is given for obtaining the propagation constant of the dissapative, anisotropic ionosphere. Special cases of the magneto-ionic formulas are given, and a comparison of the ionosphere with a distributed-constant transmission line is made.

Formulas are developed establishing, for the special case of transverse propagation in a non-dissapative ionosphere, the relationship between the effective electron density to the relative transmission delay of the 6-Mc pulse.

A description of the University of Utah vertical incidence experiment is given in which a 6-Mc pulse from an airborne transmitter is received simultaneously at several ground receiving stations. The time delay of this pulse, encountered in passage through the ionosphere, is measured relative to an ultra-high-frequency reference pulse.

The relative 6-Mc time delay data from three Aerobee high-altitude rockets launched from Holloman Air Development Center on July 1, 1953, Nov. 3, 1953 and June 13, 1956 are given. Curves showing the profile of electron density as a function of altitude as calculated, both during the rocket ascent and descent, are presented. The curves indicate a general increase of electron density throughout the E-region, rising from nearly zero at 85 km to a maximum of about 2×10^{11} electrons/m^3. The maximum altitude attained by the rockets allowed exploration up to 137 km above sea level. The curves indicate a general tendency of the E-region to bifurcation, and upon this are superimposed a considerable number of smaller striations. The results also indicate considerable horizontal inhomogeneity. A comparison is made with other experiments which have used rockets as the research vehicle. The results of the author fall within the range of results reported by other researchers in the field.

95 pages. $2.00. Mic 57-1318

ELECTRONIC DATA SORTING

(Publication No. 20,444)

Howard B. Demuth, Ph.D.
Stanford University, 1957

Sorting, the process of arranging numbers in a monotonic non-decreasing sequence, is an activity common to many data processing systems. This dissertation is a theoretical study of the fundamentals of sorting. In particular, it deals with the problem of minimizing the time required to sort data (items) with electronic equipment. Since sorting is currently the bottleneck in many data processing systems, the results should be of interest to those who use or manufacture such systems.

Sorting is first considered as an abstract process, and is analyzed without regard for the physical equipment necessary to carry out the process. Questions such as "Is there a fundamental measure of disorder in sorting?" and "What is the minimum number of two-item comparisons required to sort?" are asked and answered. The analysis reveals that sorting is a combination of two activities: (1) information-gathering, the process of making a series of comparisons of items until one has accumulated enough information about their relative sizes to establish their sorted order; and (2) item-moving, the process of actually forming the sorted sequence, subject to limitations as to how items can be handled in the physical sorting system.

Most of Sec. III is devoted to a study of information-gathering. For instance, bounds on the number of two-item comparisons required to sort are found for various cases, including cases in which there are duplicate items or in which the items are partially pre-sorted. Two new optimum or near-optimum sorting schemes are described and investigated.

Section IV is an investigation of three simple sorting models, which contain only the elements essential to sorting systems. Each model is built around a circular non-reversible (drum-like) memory, a linear reversible (tape-like) memory, or a random-access memory. For various combinations of equipment and item characteristics, optimum sorting programs for the models are derived, and mean and maximum sorting times are calculated. Study of the models has led to new methods of analysis of sorting systems and to conclusions concerning the usefulness of particular types of equipment in sorting systems.

Within this report it is shown that: (1) Under certain restrictions, some sorting systems now in existence are optimum or near optimum; (2) A type of storage system not now in existence could be used to reduce sorting time; (3) Communication-theory mathematics can be applied in studying the information-gathering activity in sorting. These results, as well as all other new results of the investigation, are summarized in Sec. II, which can be read without making reference to the proofs and discussion in Sec. III and Sec. IV. 100 pages. $2.00. Mic 57-1319

TRAVELING-WAVE AMPLIFIERS AND BACKWARD-WAVE OSCILLATORS AT VHF

(Publiction No. 19,920)

Donald Allen Dunn, Ph.D.
Stanford University, 1956

An important aspect of the design of traveling-wave amplifiers and backward-wave oscillators for frequencies below 500 Mc is the problem of obtaining a tube of reasonably small physical dimensions. Hollow beams of greater perveance than is obtainable with solid beams offer one method of reducing the size of such tubes by permitting operation at a lower voltage and greater gain per wavelength, for a specified beam power, than is possible in a

solid beam tube. Some aspects of the design of minimum size hollow-beam forward-wave amplifiers using single helix circuits and backward-wave oscillators using both single and bifilar helix circuits are presented. Several tubes of these types for operation below 500 Mc have been built. Amplifier bandwidths and oscillator tuning ranges in excess of four to one in frequency have been obtained experimentally. Amplifier efficiencies in excess of 20 per cent and oscillator efficiencies in excess of 10 per cent have been achieved. 115 pages. $2.00. Mic 57-1320

NEGATIVE-IMPEDANCE CONVERTER DESIGN

(Publication No. 20,458)

Arthur Irving Larky, Ph.D.
Stanford University, 1957

An active device with the property that the driving-point immittance at one terminal-pair is the exact negative of the load immittance connected to the other terminal-pair is called a negative-impedance converter. This work describes the external or circuit properties of the ideal negative-impedance converter and relates them to certain ideal amplifier combinations. The necessary and sufficient conditions that a given device be an ideal negative-impedance converter are derived. The properties of the non-ideal negative-impedance converter are discussed and a method shown by which the non-ideal device may be made ideal by the addition of passive elements. Practical circuits are never ideal and are also subject to changes in performance due to drifts in their elements. Sensitivity criteria are developed which indicate which of the external parameters of the device most affect the negative-impedance conversion process. These are the parameters which must be most stable and this fact leads to the statement of the characteristics of a good negative-impedance converter circuit. Two transistor negative-impedance converter circuits are analyzed and compared. One of these has been published previously and the other is new. The new circuit is shown to be superior in frequency response and to have less distortion at a given signal level. The predicted behavior of these circuits is checked experimentally. 56 pages. $2.00. Mic 57-1321

A TORQUE-SPEED APPROACH TO SERVOMOTOR SELECTION

(Publication No. 19,432)

Charles Wolf Sarture, Ph.D.
Purdue University, 1956

Major Professor: J. R. Burnett

The selection of the power actuator and its associated gearing has long been a troublesome problem in the design of control systems. A number of selection methods have been advanced, but usually they have been of an approximate nature, and they have in general failed to mesh smoothly with the existing synthesis procedures. This thesis proposes a servomotor selection procedure, which is based on the load torque-speed demand curve and which fits conveniently as a logical step in the Guillemin-Truxal servomechanism synthesis procedure.

It is rigorously shown by means of signal flow diagrams that a system with a specified C/R(s) system function, load configuration, and input, has load demand torque, velocity, and power time functions which are unique. Several methods previously proposed for selecting servomotors on the basis of demand peak-power are investigated, and it is demonstrated that, in general, a knowledge of the peak-power alone does not provide sufficient information for a proper motor selection.

It is established that the necessary and sufficient condition for linear motor operation (no saturation) for any particular input is that the dynamic load torque-speed demand curve (load torque versus load velocity for corresponding instants of time) must be completely enclosed by the steady-state torque-speed curves for the equivalent (geared) motor being proposed for the system. A method is explained which, at least in the ideal case, assures that the minimum size (power rating) motor is chosen, and it is further shown that the physical gear ratio is uniquely specified once the actual motor has been picked. Various load configurations are studied, and the very common friction-inertia load is explored at length by means of a series of acceleration-velocity curves for various system functions. Several methods for actually computing the torque-speed demand curves are developed.

A number of applications of the method are described and procedures are set forth for handling cases where the motor T-S curve is something other than a straight line; in particular, a two-phase AC servomotor and a DC motor with torque saturation are considered. The effect on the computations of motor inertia is described, and a method is devised for including it. Finally, the method is applied to instrument servomechanisms, where the major portion of the system load is the motor itself.

The torque-speed method provides a simple, yet flexible, method for accurately selecting the actuating elements of a control system. The motor selected by this method should provide linear operation over the expected range of inputs and the desired system function should be accurately realized. 122 pages. $2.00. Mic 57-1322

THE SYNTHESIS OF NETWORK MODELS FOR MULTICOMPARTMENT SYSTEMS

(Publication No. 18,353)

Robert L. Schoenfeld, D.E.E.
Polytechnic Institute of Brooklyn, 1956

The kinetics of tracers in linear, steady state systems with a finite number of compartments are treated from the point of view of electrical network theory. A formal analogy with an equivalent, passive but non-reciprocal electrical circuit is developed. A set of network functions, which differ by a multiplicative constant from those used for electrical circuits, is defined.

It is shown that equivalent models may be generated by a mapping with a linear, affine similarity transformation. This matrix relation is compared with the congruence

transformation for electrical networks. The two mappings are shown to be isomorphic when the amounts of non-labeled substance in the compartments are known.

Models are generated from the known network functions by a procedure similar to that used in network synthesis. For driving-point functions with real zeros and poles with the separation property, the synthesis is a simple application of the Foster and Cauer canonical forms for RC circuits, which are shown to be equivalent to mammilary and catenary biological models.

When the zeros of the transfer function are real, and they separate all but one of the driving-point function zeros, the model may be generated by similarity transformation from the mammilary system. In this case, the conditions for generating a unique model from the driving-point function and n-1 transfer function, are described. If not all of these network functions are known, there are degrees of freedom in the model, and the mapping defines a physically realizable region in the coordinates of this mapping space with dimensions corresponding to the degrees of freedom.

Synthesis from the driving-point function is described for systems with less than four compartments and, in special cases for higher order systems with complex roots. The domain of the roots of the system determinant and principal minors is investigated for certain special configurations. A number of necessary properties are found to characterize the driving-point and transfer function. 98 pages. $2.00. Mic 57-1323

ENGINEERING, MECHANICAL

AN EXPERIMENTAL INVESTIGATION OF FILM ESTABLISHMENT, FILM PROFILE DIMENSIONS, PRESSURE DROP, AND SURFACE CONDITIONS IN TWO PHASE ANNULAR FLOW

(Publication No. 19,205)

Howard Norbert Mc Manus, Jr., Ph.D.
University of Minnesota, 1956

An experimental investigation was made with water and air which determined (1) the effect of water inlet conditions upon annular film establishment; (2) the effect of water inlet condition upon liquid film distributions; (3) the effect of liquid film distributions upon pressure drop; and (4) the relationship between air rate, mean film depth, and maximum surface disturbance height. Additionally microflash photographs were made of the established film to study surface disturbance structure.

The test section employed was of two inch i.d. plastic tubing, 120 inches long. The Reynolds number range covered was from 75,000 to 125,000. Water rates investigated ranged from 0.092 lb/sec to 0.725 lb/sec.

It was found that the entering film thickness affected the quantity of water required to establish a film throughout the test section. Throughout the range of thicknesses investigated (0.036 in. to 0.015 in.) it was found that a thicker entering film required less water flow for complete tube wall coverage. Liquid rate variation was up to 25%.

Film depth profiles were made at stations located 2.5, 5.0, 10.0, and 23.5 diameters from the liquid injection point. The upstream station profiles were found to be sensitive to air rates, water rate, and inlet conditions. The downstream station profiles were unaffected by inlet conditions. Additionally, the upper two-thirds of the film at this station was dependent only on air rate; water rate influenced film depths only in the lower part of the tube. Vertical symmetry existed in the profiles at all but the upstream station. In all cases, films were much thicker in the lower part of the tube than the upper. Film depths measures ranged from 0.006 in. (upper) to 0.100 (lower).

Pressure drop was measured over two lengths of test section. The pressure loss in the section adjacent to the water admitting device showed a sensitivity to inlet conditions. For constant water rate, a thin film at admission caused a higher pressure drop in this section. For the range of entering film thickness covered (0.036 in. to 0.015) the pressure drop variation exceeded 15%. The pressure loss in the downstream section was unaffected by inlet conditions.

Disturbance height was found to be affected by mean film depth and air rate. A higher air rate would cause a substantial increase in wave height for a given film depth. Also, increased film depth with constant air rate caused an increase in disturbance height. It was ascertained that maximum disturbance height affects pressure drop severely.

Photographs of the film surface disclosed that surface disturbance form was affected by air rate and water rate. The latter influenced disturbance structure by affecting pressure drop, and hence, air laminar sublayer thickness.

A dimensionless correlation was determined for all depth measurements obtained in the upper two-thirds of the tube. Radial position was used as a parameter.
173 pages. $2.30. Mic 57-1324

THE BURNING VELOCITY OF METHANE-OXYGEN-NITROGEN MIXTURES AT HIGH PRESSURES

(Publication No. 19,434)

Donald Lewis Smith, Ph.D.
Purdue University, 1956

Major Professor: John T. Agnew

The constant-volume bomb method has been used to determine the burning velocity of methane-oxygen-nitrogen mixtures as a function of pressure from one tenth of one atmosphere to twenty atmospheres. The methane and oxygen were in stoichiometric proportions in each mixture.

In order to obtain data for initial pressures up to twenty atmospheres, with corresponding peak explosion pressures of the order of 180 atmospheres, a new method was devised for the determination of flame position as a function of time. The gas mixture in a spherical bomb was ignited at the center of the combustion chamber by a spark. Ionization gaps were placed in the combustion chamber at known distances from the point of ignition. The time for the flame to travel from the point of ignition to each ionization gap was measured by means of a dual-beam oscilloscope and a drum camera. The burning velocity was

computed by using the information obtained from the ionization gap measurements.

The burning velocity for a stoichiometric methane-air mixture in a 10 inch spherical bomb at different pressures is listed in Table i.

Table i

Burning velocity at room temperature for stoichiometric methane-air

Pressure	Burning Velocity	
Atmospheres	in/sec	cm/sec
1	14.1	35.8
2	12.5	31.8
5	9.4	23.6
10	6.9	17.5
20	4.2	10.7

The burning velocity for the $CH_4 + 2O_2 + 2.25N_2$ mixture at various pressures is given in Table ii. For this mixture data could not be obtained above 5 atmospheres due to excessive heat release which melted the ionization and ignition electrodes.

Table ii

Burning velocity at room temperature for a stoichiometric methane-oxygen-nitrogen mixture which contained 42.8 percent nitrogen

Pressure	Burning Velocity	
Atmospheres	10 inch Bomb	
	in/sec	cm/sec
1/2	75.9	193
1	78.5	199
2	80.8	205
5	83.8	213

The burning velocity for stoichiometric methane-oxygen at pressures of one tenth of one atmosphere and one atmosphere in two different bombs is given in Table iii.

Table iii

Burning velocity at room temperature for a stoichiometric methane-oxygen mixture

Pressure	Burning Velocity			
Atmospheres	5.0 inch Bomb		10.0 inch Bomb	
	in/sec	cm/sec	in/sec	cm/sec
1/10	143	363	152	386
1	196	497	222	564

Manton and Lewis* have proposed that all hydrocarbon-oxygen-inert gas mixtures obey the general equation,

$$\frac{S_{u\,(a)}}{S_{u\,(b)}} = \left(\frac{P_{(a)}}{P_{(b)}}\right)^{x}$$

where x may be positive, negative, or zero. The experiments reported in this thesis confirm the fact that the burning velocity may either decrease or increase with pressure, but not according to this simple relationship. The Manton and Lewis equation is based upon measurements at one atmosphere or less; whereas the data reported herein covers a much higher pressure range.

New relationships having the same general form are given for the pressure dependency of the burning velocity for stoichiometric methane-oxygen mixtures containing various amounts of nitrogen as the inert gas.

89 pages. $2.00. Mic 57-1325

*Selected Combustion Problems - AGARD - p. 176.

SECOND ORDER ACCELERATION

(Publication No. 19,444)

James Charles Wolford, Ph.D.
Purdue University, 1956

Major Professor: A. S. Hall, Ph.D.

Accelerations of higher order have been of some theoretical interest for many years in the theory of curves and their higher evolutes. More recently the increased speeds at which cam mechanisms operate have made the second order acceleration an important factor in cam design. Likewise second order acceleration should be of importance in the design of high speed linkage type mechanisms inasmuch as high rates of change of acceleration imply rapid changes of the magnitude or direction of applied forces. This causes vibration and higher stresses than would be present for slow changes in the magnitude or direction of the forces.

In this study, derivations are made for three relative second order accelerations in plane motion which are useful in making second order acceleration analyses of mechanisms.

1. The second order acceleration of a point on a rigid link relative to another point on the same rigid link.
2. The second order acceleration of a point on a moving link relative to a coincident point on another moving link. This relative second order acceleration includes a complementary component analogous to the Coriolis component of first order acceleration.
3. The second order accleration of a point on a moving link relative to a coincident point on another link where the two points have zero relative velocity. Where one of the links is fixed, this is the second order acceleration of the point of zero velocity of the moving link.

Rules regarding the direction and sense of the components are given and examples are shown illustrating the use of these three relative second order accelerations.

Mechanisms which contain "floating links" cannot always be analyzed directly by the usual relative velocity and relative acceleration methods. However, a direct solution may be possible with the use of an "auxiliary point." Likewise the usual direct solution for second order acceleration will not always be possible with mechanisms containing floating links. The use of auxiliary points in second order acceleration analysis of such mechanisms is explained and shown by example.

A study is made of several possible kinematic applications of second order acceleration. An equation is derived for the rate of change of the radius of curvature for the

path of a moving point. Evaluation of this equation requires finding the second order acceleration of the moving point.

A method is shown for improving a six bar dwell mechanism by relocating the coupler point to a nearby position so that the rate of change of the radius of curvature of the path of the coupler point is less.

A derivation is given for the "cubic of stationary curvature" using a second order acceleration analysis along with velocity and acceleration analyses.

A derivation is given of an equation for the rate of change of the radius of curvature of the fixed polode of a four bar linkage with respect to arc length along the polode and the equation is used in an example. The value obtained is checked by comparing it with the tangent to the curve plotted for radius of curvature of the fixed polode against distance along the polode.

191 pages. $2.50. Mic 57-1326

ENGINEERING MECHANICS

SINGULAR SOLUTIONS IN THE THEORY OF SHALLOW SHELLS

(Publication No. 20,443)

David Andrew Conrad, Ph.D.
Stanford University, 1957

The problem of the elastic bending of arbitrarily loaded and heated shallow shells is considered. The linear differential equations for small displacements of shallow shells of arbitrary shape are developed. By means of the assumption that the temperature is known on the surfaces of the shell, the necessary additional terms in the differential equations are obtained.

Three representative shapes — the sphere, cylinder and hyperbolic paraboloid — are studied in detail. Singular solutions representing the concentrated force and the plane and bending hot-spots (extremely localized heated areas) are developed for these cases. Such solutions serve two purposes. First, they are in themselves useful for the study of the effects of concentrated forces and hot-spots, and second, they provide the singular portion of the Green's function of the problem, from which solutions may be developed for arbitrary loading and heating. Edge load solutions for rectangular boundaries are also presented for these cases.

Three examples have been calculated and the resulting stresses are presented graphically. These are a simply supported shallow sphere and a freely supported cylinder and hyperbolic paraboloid, all centrally loaded by a concentrated force. 108 pages. $2.00. Mic 57-1327

CONTRIBUTIONS TO THE ANALYSIS OF NONLINEAR OSCILLATIONS

(Publication No. 20,462)

Michael Joseph Nowak, Ph.D.
Stanford University, 1957

An energy principle is developed for quantitative analysis of nonlinear oscillations, and applied to several classically important problems, particularly Duffing's oscillator with both hard and soft nonlinearity. This energy principle renders stationary in time the total energy in the system; the physical significance of this method is shown. This method for analysis of nonlinear oscillations is compared with other methods of nonlinear analysis, in particular the iteration method using the superpositon integral and the unit response function.

To facilitate the application of these methods the pertinent properties of Fourier analysis are developed, and in particular a combinatorial method is devised for filtering out the lowest harmonic components in the functional formed from the differential equation. The symmetry of the Fourier components is related to the form of the governing differential equation; the fundamental properties of half cycle Fourier analysis are developed and the relation between these and the full cycle properties is given.

An extended solution of the Duffing equation is also made by use of the iteration method, and a method is developed for determining bounds for the error in the oscillation wave shape.

An exact zero frequency analysis of the soft Duffing oscillator is made, and it is shown that the usual analysis based on just the fundamental component of the nonlinear oscillation is invalid at low frequencies. At zero frequency the problem reduces to an algebraic one which can be solved exactly; several essentially nonlinear phenomena such as subharmonic oscillation, jump oscillation, and oscillation about a non-zero mean value, can occur. By introduction of an equivalent frequency the differential equation can be reduced to an algebraic one at all frequencies, and many of the zero frequency results can be extended to all frequencies.

136 pages. $2.00. Mic 57-1328

A LARGE DEFORMATION THEORY OF SHELL MEMBRANES

(Publication No. 20,466)

Peter Marshall Riplog, Ph.D.
Stanford University, 1957

The problem of large deformations of an arbitrary membrane of revolution subjected to a general axi-symmetric loading is considered. The non-linear differential equations are developed under the assumption that the material follows Hooke's law throughout. The procedures for handling these equations for particular loadings are given.

Three representative shapes: the cylinder, the cone, and the sphere are considered in detail. Problems involving pressure loads, radial loads, and edge loads are treated. Numerical solutions re obtained for both a cylindrical and a conical membrane pressure vessel. The

deformed shapes of a spinning spherical membrane are determined for several different angular velocities.

The linear theory of prestressed membranes is considered briefly with primary emphasis being placed on axially prestressed membranes subjected to radial loads.

108 pages. $2.00. Mic 57-1329

ENGINEERING, METALLURGY

THE OXIDATION BEHAVIOR OF PURE METALS AND ALLOYS (PARTS I-VIII)

(Publication No. 17,564)

John P. Baur, Ph.D.
University of Utah, 1956

Chairman: John R. Lewis

The following systems were investigated: Ta, Cu, Nb, Mo, W, Mg, Zr, Ti in oxygen under the conditions of a linear increase in temperature and constant pressure. $Cu/Cu_2O/O_2$, $Cu/Cu_2O/CuO/O_2$, $Co/CoO/O_2$, $Fe/FeO/Fe_3O_4/Fe_2O_3/O_2$, $W/WO_3/O_2$, and $Ni/NiO/O_2$ under the conditions of constant temperature and constant pressure.

The kinetics of the reaction of pure metals and oxygen were investigated under conditions of constant temperature and constant oxygen pressure and also under the conditions of a linear increase of temperature and constant pressure. The effect of oxygen pressure upon the oxidation rate was interpreted for both diffusion-controlled (parabolic) reactions (Cu, Co, Fe, and Ni) and those cases where the slow step is a boundary reaction (linear) (Ta and W). The variation of oxygen gas concentration (pressure) was shown to result in the acceleration of the rate of oxidation in the cases of both parabolic oxidation involving a metal-deficit semiconductor oxide-oxygen interface (CoO/O_2, NiO/O_2, and Cu_2O/O_2) and in the case of a boundary reaction controlled (linear) oxidation rate (W, Ta). Eventually in both investigated cases the rate of reaction (for constant temperature) ceased to increase despite substantial increase in oxygen gas concentration. This cessation was postulated to be due to saturation of the available surface sites for the accommodation of adsorbed oxygen gas molecules or, alternatively, in the case of parabolic oxidation involving metal-deficit semiconductor oxides, to the saturation of the cation vacancies. Where the semiconductor oxide adjacent to the oxygen gas phase is a transition type semiconductor and the reaction is diffusion-controlled (Fe_2O_3/O_2 and CuO/O_2) the variation of oxygen pressure had no effect upon the oxidation rate.

Oxidation rates are included for the high temperature-high pressure oxidation of four commercial Fe-Cr-Ni alloys.

198 pages. $2.60. Mic 57-1330

THE APPLICATION OF DYNAMIC ADIABATIC CALORIMETRY TO THE COPPER-NICKEL SYSTEM FROM 50 TO 620°C

(Publication No. 20,499)

Richard E. Pawel, Ph.D.
The University of Tennessee, 1956

Major Professor: E. E. Stansbury

This dissertation represents a contribution from a calorimetry research program which has been in progress during the past several years at The University of Tennessee as part of an Atomic Energy Commission research grant. Initial phases of the program were concerned with the design and construction of dynamic adiabatic calorimeters. Two calorimeters are now being used to determine metallic specific heats, heats of transformation, and other measurable heat effects. These data are useful and necessary in the complete analysis of metallic systems.

The phase of research reported in this dissertation is primarily concerned with the methods of extracting self consistent and reproducible specific heat values from the data obtained in one of the above calorimeters. Since one of the long range objectives of this program was the determination of the very small increase in internal energy of plastically deformed specimens, a very high degree of accuracy and reproducibility was necessary. In order to obtain this accuracy, several problems inherent in high temperature operation were reconciled.

The calorimeter consists of a long monel tube with one main and two auxiliary nichrome windings. The inside of the tube, which houses the specimen, is kept under high vacuum, about 5×10^{-5} mmHg., to keep convection losses low; the outside of the tube is flooded with helium to increase the heat response from the windings. The specimen, heated by an internal resistance heater, is maintained under adiabatic conditions by a series of controllers actuated by the amplified outputs of platinum-platinum 13 per cent rhodium differential thermocouples. The thermocouple system allows measurements of absolute temperatures, temperature differences, and spurious emf's in all components of the apparatus. The repression of these spurious potentials was an important step in the improvement of the data.

The conclusions reached in this phase of the program may be summarized as follows:

1. Through the use of careful techniques, and the solution to some of the experimental difficulties associated with high temperature operation, the design and operation of the calorimeter used in this research has reached a stage where extremely reproducible and self consistent specific heat data on metallic systems can be obtained.

2. The specific heats of copper, nickel, and several copper-nickel alloys were obtained between room temperature and 620° C, with an error of less than ± 0.5 per cent. These data represent a significant contribution, especially in the case of nickel, at temperatures above the Curie point.

3. The stored energy values reported for cold-worked copper in this research, 0.23 to 0.37 calories per gram, appear high compared with the data of Gordon and Clarebrough, and low compared with the data of Suzuki, Quinney and Taylor, and other early investigators. These data represent only the results of exploratory experimentation,

and the techniques will have to be improved in order to increase the reliability of the stored energy data.

151 pages. $2.00. Mic 57-1331

A KINETIC STUDY OF THE CORROSION OF LOW HAFNIUM ZIRCONIUM IN ACID SOLUTIONS AND TRUE SURFACE AREA MEASUREMENTS OF ZIRCONIUM PLATES

(Publication No. 17,582)

Tennyson Smith, Ph.D.
University of Utah, 1956

Chairman: Dr. George Richard Hill

The rate of dissolution of zirconium in hydrofluoric acid solutions has been studied using a radioactive tracer, Zr^{95}. By an appropriately designed system, a continuous record of the rates could be made.

The rate has been found to be dependent upon the HF (free acid) activity alone, at constant temperature. A number of possible mechanisms for the slow step are suggested, the most likely one being the diffusion of HF to the zirconium surface.

The reaction products are demonstrated to be mostly ZrF_3^+ ion in solution, and H_2 in the gas phase. The activation energy for the slow step is 3.3 kcal per mole.

The rate of dissolution of zirconium in sulfuric acid solutions has also been studied. In sulfuric acid solutions the rate is slower than in hydrofluoric acid by a factor of approximately 10^4. The activation energy for the slow step is about 7 or 8 kcal/mole. The gaseous product of the reaction is hydrogen. The reaction rate is first order with respect to H_2SO_4 (free acid), and is independent of any other species in solution. It is postulated that the slow step consists of H_2SO_4 (free acid) diffusion to the zirconium metal surface through a protective oxide film, probably at cracks or dislocations in the film.

The third problem that was studied concerned the applicability of measuring true surface areas or noting changes in the true surface area of zirconium metal plates by measuring the capacitance of the surface in aqueous solutions. The capacitance of a mercury surface in sulfuric acid solutions was measured using various initial voltages. The measurements on mercury correlated well with that given in the literature. Capacitance measurements on zirconium showed that changes in the true surface area can be measured if conditions are such that the zirconium oxide film does not change. It is shown that by measuring the oxide film thickness by an optical method, true surface areas can be determined.

130 pages. $2.00. Mic 57-1332

THE EUTECTIC REACTION IN CERTAIN BINARY METALLIC SYSTEMS

(Publication No. 20,655)

Harry Waldron Weart, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor David J. Mack

The literature concerning binary eutectics from their discovery in 1876 to the present revealed a confusing multiplicity of microstructures, not only between eutectics in different systems but within any given eutectic specimen. Most apparent was the lack of control over growth conditions which has recently been shown to have a large effect on the structure of single-phase alloys.

Specimens of aluminum-zinc, aluminum-copper (κ-θ) and tin-zinc eutectics were prepared by solidifying unidirectionally at 0.412 to 8.29 millimeters per minute under impressed temperature gradients of 5 to 40 Centigrade degrees per centimeter and were examined metallographically by conventional techniques. Also studied were solid-liquid interfaces prepared by partially solidifying specimens under the above conditions and then rapidly separating the solid from the liquid into which it was growing.

The eutectics studied solidify by movement of a cellular interface through the melt, thereby producing colonies which display three regions: center, where both phases grow parallel to the growth direction; boundary region, where at least one phase grows perpendicular to the cell surface and therefore curves toward the boundary during growth; boundary proper, in which phase particles are coarse, randomly oriented and irregularly shaped.

Colony morphologies and cell shapes were determined to be: Al-Zn, rounded cells containing flattened α' (Al-rich) rods in a matrix of β (Zn-rich); Al-Cu, angular cells in which κ (Al-rich) and θ ($CuAl_2$) were present as alternate plates, with the possibility that either phase could break down to form rods; Sn-Zn, ridged lenticular cells containing β (Zn-rich) discs or short, discontinuous laths in an α (Sn-rich) matrix. Al-Zn and Al-Cu colonies are rod-like growing lengthwise, while Sn-Zn colonies are slabs growing edgewise. The characteristics of the alloy system which determine these shapes were not established.

Increasing the ratio V/G where V is growth rate and G is temperature gradient produces shorter colonies which are less distinct and deviate more strongly from the specimen axis. This change in V/G also causes the appearance and increase of primary phase particles in the systems studied. Cell size is less strongly influenced by V/G ratio changes but the effect varies with the alloy system.

All experimental results were explained by an extension to eutectic alloys of recent information on solidification of single-phase alloys. It appears that the two-phase eutectic interface can reject an atomic species and produce a region of constitutional supercooling which results in the formation of a cellular interface. The rejected atomic species can be one of the alloy components or an impurity.

200 pages. $2.60. Mic 57-1333

THE WYOMING VALLEY: A STUDY OF ITS CHANGING FUNCTIONS

(Publication No. 20,621)

Samuel Earl Brown, Jr., Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor John W. Alexander

This dissertation is an analysis of two fundamental aspects of the economic geography of the Wyoming Valley of Pennsylvania. The geographic aspects chosen for investigation are (1) changes in the intra-regional relationships between several selected elements within the Wyoming Valley associated with a significant change in the economic base and (2) changes in the inter-regional relationships between the Valley and other areas associated with the economic base transition. An attempt is made to devise techniques for revealing such relationships. To accomplish these purposes requires an analysis of the functional changes as revealed in the employment structure of several periods of time and of the factors responsible for such changes.

The labor force was analyzed for the census years, 1930, 1940, and 1950. The year 1930 marks the last period when mining was the chief element of the employment structure, occupying 32% of the labor force. By 1950 mining employed only 16% of the labor force while manufacturing became the leading activity, employing 26%. This was accomplished after a transition period when one-third of the labor force was unemployed.

Mining declined because of competition from substitute fuels for home heating, anthracite's chief market. Also the industry suffers from increasing production costs and depletion of the resource. This, plus the loss of textile firms in a move southward, resulted in excessive unemployment. Through the efforts of industrial foundations, industries are being attracted to the region because of its position close to large markets with an excellent transportation network to serve them. Also the area contains a large labor pool and available factory space.

Several characteristics of the region revealed changes associated with the altered function of the Wyoming Valley. Population declined, with many of the younger people leaving the area. Housing was affected; quality, rental characteristics, and recency of construction do not compare well with surrounding areas.

The number of retail stores declined at a faster rate than that of the state or nation. The amount of trade and the effective buying income increased at slower rates than in comparative areas. Similar trends were noted for per capita retail sales and per capita effective buying income.

Changes in the basic-nonbasic employment ratio were computed; basic employment predominated in 1930, nonbasic by 1950. This reversal stems not from any great percentage change in basic employment in each category, but rather from absolute changes in employment therein.

An "index of relative market area strength" was devised to ascertain any re-orientation of the market area for the Valley's goods. The northeast remains its major market, but inroads are being made into the South, the Lake States, and the West. Similar analysis of areas supplying raw materials for the Valley's industry revealed declining significance of the South and Pennsylvania and increasing importance of other northeastern states.

While the region's railroads, once thriving on coal movement, suffered severely, motor freight carriers benefited by the functional change.

With the continued decline in anthracite mining, the Wyoming Valley still faces problems of adjustment. With a favorable market situation and excellent transportation facilities, it is making the shift to a manufacturing-based economy. 239 pages. $3.10. Mic 57-1334

A GEOGRAPHICAL ANALYSIS OF INDIA'S POPULATION

(Publication No. 20,237)

Gurdev Singh Gosal, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Glenn T. Trewartha

This study aims at revealing regional differences in the distribution of numbers and characteristics of India's population, and the causal relationships of such differences with other phenomena, physical and cultural.

The regions with densities exceeding 400 persons per square mile, the Ganges Plain and the narrow lowlands on the eastern and western coasts, are peripheral to hilly Peninsular India, and to the desert. In spite of alluvial soils and abundant rainfall, relatively low population density in Assam Valley is attributable to frequent invasions in the past by hilly hostile tribes, prevalence of epidemic diseases, relative isolation of the Valley and the recovery of advanced paddy culture. The relationship between the population density and capacity of land to produce food is modified in some areas by increased urbanization and development of non-agricultural occupations in rural areas, as in southern India.

Population growth since 1921 has been slow in areas of high agricultural density (Ganges Plain and Orissa Littoral) indicating that under existing technology the saturation level has been reached. Also, in the famine areas in Central India population has shown signs of net arrest. In southern and western India growth has been more rapid due to increasing urbanization, extension of agriculture to upland areas, as in Mysore, Coorg and Nilgiris, and to rapidly declining mortality. Growth has also been rapid in the Assam frontier area.

Birth rates are below the national average (40) in the densely populated areas of the Ganges Plain, Orissa and in southern India; and highest (exceeding 44) in Assam and Central India. In general there is high inverse correlation between nutritional density and birth rate.

Death rates are lowest in the coastal areas, and highest in areas liable to frequent occurrence of droughts, as in Central India, and in areas haunted by epidemics, as in Assam.

There is a serious deficiency of females in northwestern India, Assam, and in highly urbanized parts of Bengal and Bombay states, while there is excess of females in most of the coastal areas resulting from male-selective emigration.

Between 20 and 50 per cent of the population in the coastal areas is literate, attributed mainly to an earlier start of educational institutions and the efforts of missionaries. Areas of lowest literacy (below 8 per cent), especially in rural areas, are in most cases former native states. Rural literacy is highest in areas served by missionaries as in Travancore-Cochin, Coorg and Assam.

Rural population in India is not synonymous with agricultural population. In upper Jamna-Ganges Doab, northern Panjab, Malabar, Assam and lower West Bengal plain a quarter to over a third of the rural population derives its livelihood from non-agricultural occupations, among the most important of which are the cottage industries and handicrafts. By contrast, in northern Ganges Plain, the Himalayan region of northwestern India, and in the tribal areas of Assam, Central India and Orissa, over 90 per cent of the rural people depend on agriculture.

Degree of urbanization is strongly correlated with proportion of population depending on non-agricultural occupations. In the predominantly subsistence farming areas of Assam, lower and middle Ganges Plain, Rajasthan, Central India and Orissa urban development is very meager. Regions with a high degree of urbanization are, in most cases, conincident with areas of cash-crop farming and those of industrial and commercial development, such as lower West Bengal Plain, Upper Ganges Plain, northern Panjab, southern India south of latitude 13°N. excepting Malabar, and Bombay state. The development of hydroelectric power in the upper Ganges Plain and in southern India has played an important role in stimulating industrialization and urbanization.562 pages. $7.15. Mic 57-1335

GEOLOGY

REGIONAL GRAVITY SURVEY OF PARTS OF TOOELE, JUAB, AND MILLARD COUNTIES, UTAH

(Publication No. 18,712)

John Burlin Johnson, Jr., Ph.D.
University of Utah, 1956

Chairman: Kenneth L. Cook

In the summer of 1955 a regional graviety survey was made in parts of Tooele, Juab, and Millard Counties, Utah in order to obtain information on the regional geologic trends in the area and facts pertinent to ground-water and mineral exploration. A total of 455 gravity stations were occupied with spacings of about 2 to 5 miles in an area of about 1700 square miles, and a Bouguer anomaly map was drawn, contoured at intervals of 2 milligals. Three theoretical profiles were computed with a two-dimensional graticule across three major anomalies found in the region.

The regional gravity map reflects the density contrasts resulting from all past geologic events, with anomalies resulting from the recent Basin and Range orogeny predominating.

North of the 40th Parallel several regional gravity anomalies indicate probable major Basin and Range faults along the eastern margin of the southern end of the Cedar Mountains, west of Davis Mountain, east of Camels Back Ridge and Simpson Buttes, north of the Dugway Range, and east of Granite Mountain. One graben or faulted trough probably lies between Davis Mountain and Camels Back Ridge, and another lies east of Granite Mountain.

South of the 40th Parallel two major breaks were discovered trending transverse to the Dugway Range and the Thomas Range. These events probably antedate the Basin and Range orogeny.

No steep gravity gradients were discovered in the vicinity of the Drum Mountains or Simpson Mountains, although the gravity over the Simpson Mountains has an unusually low value.

The gravity anomalies associated with Basin and Range faulting north of the 40th Parallel trend in a northwesterly direction. The pre-Basin and range events south of the 40th Parallel trend westerly. A regional gradient of about -1.3 milligals per mile toward the southwest occurs in the surveyed area. 55 pages. $2.00. Mic 57-1336

THE GEOLOGY OF THE MOUNT FLEECER AREA, MONTANA

(Publication No. 19,470)

George T. Moore, Ph.D.
Indiana University, 1956

The Mount Fleecer area (Ts. 1 and 2 N., Rs. 10 and 11 W.) is approximately 20 miles southwest of Butte, Montana, and can be considered the northern extremity of the Pioneer Mountains.

Sedimentary rocks of Proterozoic, Paleozoic, Mesozoic, and Cenozoic ages are exposed in the area. Ordovician, Silurian, and Jurassic rocks were not recognized.

Compressive forces of the Laramide orogeny folded and faulted the pre-Cenozoic sedimentary rocks in this area. A series of north- and northwest-trending anticlines and synclines was developed in Paleozoic and Mesozoic rocks. Longitudinal and transverse faults have broken the continuity of the folds. Gently folded Proterozoic rocks were thrust on this structural complex. Low grade regional metamorphism accompanied deformation.

Upper Cretaceous to Lower Tertiary(?) biotite-hornblende granodiorite and quartz monzonite plutons have

intruded and metamorphosed the deformed sedimentary rocks. Two stocks in the area appear to be localized by structure. Two facies in the Boulder batholith suggest multiple emplacement.

A stratigraphic sequence of Lower to Middle(?) Tertiary andesite, tuff, dacite and latite, and basalt were extruded over an erosion surface which truncates the folds, faults, and intrusions. Middle Tertiary fluviatile deposits filled broad ancestral river valleys dammed by crustal warping and/or extrusion. Pleistocene glaciation has modified some of the tributary valleys. Recent erosion is exhuming parts of the former drainage system.

Several areas contain deposits of phosphate. More detailed geologic mapping will have to be undertaken before the phosphate reserves will be known accurately.

116 pages. $2.00. Mic 57-1337

THE GEOLOGY AND PETROLOGY OF THE CRYSTALLINE ROCKS OF THE BECKLER RIVER-NASON RIDGE AREA, WASHINGTON

(Publication No. 20,393)

Keith Floyd Oles, Ph.D.
University of Washington, 1956

The Beckler River-Nason Ridge area occupies approximately 200 square miles of parts of Chelan, King, and Snohomish Counties in the northern Cascade Mountains of Washington.

The rocks are dominantly phyllites, schists, gneisses, and directionless granitoid rocks which have been derived from sediments of probable Paleozoic and possibly in part lower Mesozoic age. The orogeny which produced these rocks probably occurred during latest Triassic to earlier Jurassic time.

The isochemically metamorphosed rocks are phyllites, schists, amphibolites, and lime silicate granulites. The banded graphite-sericite-chlorite phyllites are representative of the epizone of regional orogenic metamorphism.

The schists are dominantly biotite-quartz schists. These are characterized by pronounced banding, by quartz in exudation layers, lenticles, and boudin-like aggregates, and by the aluminum excess minerals kyanite, staurolite, and sillimanite. Schists which contain kyanite and/or staurolite belong to the warmer mesozone of regional orogenic metamorphism. Those containing sillimanite belong to the katazone. Kyanite and staurolite occur as stable associates and the separate kyanite and staurolite zones of Barrow are not applicable to this area.

Hornblende- and tremolite-bearing biotite schists are described. Certain schistose rocks in which an amphibole exceeds 60% of the mineral assemblage are designated as ortho-amphibolites. In addition to the schistose rocks, diopsidic lime silicate granulites are present.

The isochemically metamorphosed rocks are interpreted as being derived from sediments and minor intercalated volcanic rocks through processes of regional orogenic metamorphism. The aluminum excess biotite-quartz schists probably formed from rather pure argillaceous sediments; the hornblende schists from tuffaceous shales or greywackes. The amphibolites are considered to have had volcanic sources: the tremolite-bearing amphibolites possibly from dolomitic tuffs; the hornblende-bearing amphibolites from andesitic to basaltic tuffs or flows. The lime silicate granulites may have been derived from calcareous-dolomitic sandy shales.

The terms "granitic" and "granitoid" are used to designate grained rocks ranging in composition from diorite to granite. Three main groups of granitoid rocks are described.

Heterogeneous migmatitic gneisses are extremely variable in composition and texture. They show infinite gradation between isochemically metamorphosed schists and fine- to coarse-grained granitic gneisses. The aluminum excess minerals or the amphiboles of adjacent schists are inherited by the migmatitic gneisses. The foliation of the gneisses is parallel to that of included bodies of schist and that of adjacent schists.

Granitic gneisses of migmatitic derivation are commonly quartz diorites. Locally they are alaskitic or trondhjemitic. These gneisses grade into migmatitic gneisses and schists. Elongate mafic minerals, compositional variations, relict stringers and lenticles of schist, and biotite- or hornblende-rich bands mark the foliation of these rocks. This foliation is parallel to that of adjacent migmatitic gneisses and schists.

Directionless granitoid rocks form the bulk of the rocks of the area. They are gradational with granitic gneisses and the more obviously foliated rocks. Textures are crystalloblastic, and relict stringers of gneiss and schist material are parallel to adjacent foliated rocks. The composition of the granitoid rocks is variable. There are quartz diorites, trondhjemites, granodiorites, and alaskites.

The granitoid rocks are interpreted as having formed from pre-existing schists by processes of syn- and post-kinematic regional metasomatism. There was an introduction of sodium, silica, and minor potassium, with resultant changes in texture, structure, and composition.

On the western side of the mapped area there was a marginal mobilization of the main granitic mass and an intrusion of the phyllites by granodiorites.

A porphyritic hypersthene andesite flow and dike of late Cenozoic age are located in the northernmost part of the mapped area.

216 pages. $2.80. Mic 57-1338

HEALTH SCIENCES, GENERAL

THE ROLE OF BONE IN SODIUM METABOLISM WITH PARTICULAR REGARD TO SURGICAL PATIENTS

(Publication No. 20,544)

James Hugh Casey, Ph.D.
University of Minnesota, 1956

Certain aspects of sodium metabolism cannot be described by overall balance studies since certain discrepancies occur under pathologic circumstances when balance data are compared with changes in total extracellular sodium. One such discrepancy occurs in the early postoperative period during which time serum sodium levels often paradoxically fall in the face of positive sodium balance as measured by records of intake and output.

The possibility that the large excess of sodium in the chloride-free residue of bone may act as an active reservoir which adsorbs sodium in the postoperative patient prompted the following experiments. In addition extra bone sodium as a source of additional base during acidosis or as a sponge to take up excess body sodium during periods when sodium intake is excessive was also investigated.

In order to explore the role of bone sodium in the surgical patient, electrolyte balance studies were performed in 17 patients undergoing pulmonary resection. The electrolyte composition of the resected ribs were determined and compared to that of ribs biopsied on the second postoperative day. The cortex of the rib sections was mechanically separated from the marrow and dried for 48 hours at 105^{0} C. Weighed aliquots of the dried cortical bone were dissolved in nitric acid and the calcium was removed by three successive precipitations with oxalic acid in alkaline solution after the method of Bergstrom and Wallace. Chloride concentration was determined by amperometric titration with silver nitrate, a method similar to that described by Kolthoff. When these methods were applied to the analysis of known mixtures of sodium, potassium and calcium salts in the approximate proportion found in bone, accuracy was found to be within 1.5 percent. The composition of different ribs removed from any one individual was found to be identical within the range of laboratory error when thoracoplasty or autopsy material was studied.

The extra bone sodium (the difference between total bone sodium per kilogram of dry cortical bone and the sodium present in solution in the extracellular fluid of bone) was calculated from the following formula:

$$\frac{\text{Chloride/kg. bone}}{(Cl^{-})_{E}} \; X(Na^{+})_{E} = \text{extracellular sodium/kg. bone}$$

Total sodium content of 1 kg. of bone minus extracellular sodium in 1 kg. of bone equals extra bone sodium in mEq./kg.

Comparison was then made between the rib electrolyte data and the balance data. Although discrepancies existed in seven of the seventeen patients as regards the appropriativeness of serum sodium levels with the state of sodium balance on the second postoperative day, in all instances bone sodium variation between the time of thoracotomy and the time of biopsy two days later was slight and could not account for the discrepancies in the balance studies.

Experiments on acute salt loading and acute and chronic sodium depletion and acidosis were performed on rats, and to a more limited extent on human subjects. The sodium constitution of marrow free bone did not change with the acute experiments but chronic depletion caused lowering of bone sodium in both human subjects and rats, thus suggesting that bone sodium is an integral part of the calcium phosphate bone salt. Only when the environment is altered for a period long enough to permit resorption of bone with subsequent regeneration with available supplies does the sodium content of bone change. The exclusive use of marrow-free bone is emphasized in order to eliminate false changes in bone sodium.

Patients with compensated rheumatic heart disease exhibiting expanded radioactive sodium exchange values have normal bone sodium values.

The rate of increase in the bond sodium with age was also demonstrated. 91 pages. $2.00. Mic 57-1339

HEALTH SCIENCES, NUTRITION

A STUDY OF THE FEASIBILITY OF IMPROVING THE ACCURACY OF AN IRON BALANCE STUDY WITH HUMAN SUBJECTS BY USE OF THE DRY-WEIGHT OF THE FECES

(Publication No. 19,772)

Elizabeth Kai-Li Diao, Ph.D.
Cornell University, 1956

Correct fecal division is important in all balance studies and especially in ones concerned with iron because almost all of the iron output is in the feces. The object of this study was to find whether errors in fecal division can be corrected by the use of fecal dry-weight.

This study was part of a larger one. Nine normal healthy women 22 through 36 years of age served as subjects. The experiment extended through 112 days and was divided into 4 28-day treatment periods. The only difference in the food intake in the treatment periods was the addition of iron preparations to the bread. Each treatment period was subdivided into 7 4-day collection periods. Carmine was used as a fecal marker. Aliquot amounts of 4-day composites of the feces were dried to a constant weight. The possible causes of variability in fecal dry-weight were investigated to find whether the fecal

dry-weight for a given individual on a constant diet is constant.

The mean daily fecal dry-weight for the 9 subjects on a diet containing 2,140 calories was 20.9 gm. Some evidence that the dry-weight decreases the longer food remains in the digestive tract was found both among the subjects and among treatment periods for individual subjects. In neither case was the evidence consistent for all subjects. Menstruation was found in some subjects to cause an increase in fecal excretion. The correlations between the dry-weight and the iron content of the feces were statistically significant at the 0.1% level for all subjects. This and other evidence indicated that errors of fecal division were an important cause of variation in fecal dry-weight among 4-day collection periods. However, among 28-day treatment periods errors of fecal division were a much less important cause of variation.

The conclusion was that adjusting the mean iron content of the feces for treatment period by use of a mean value for fecal dry-weight for all treatment periods is not a sound procedure because other factors than errors in fecal division may be important causes of variation in fecal dry-weight. 71 pages. $2.00. Mic 57-1340

HEALTH SCIENCES, PATHOLOGY

HEPATIC MORPHOLOGY AND FUNCTION IN EXPERIMENTAL LIVER DAMAGE

(Publication No. 19,003)

Dieter Koch-Weser, Ph.D.
Northwestern University, 1956

SUMMARY

With the purpose of determining the functional significance of structural changes, a number of experimental hepatic lesions was produced in white rats and biochemical changes in liver tissue and serum investigated.

Intraperitoneal injection of carbon tetrachloride produced centrolobular necrosis and fatty metamorphosis. Ethionine given by the same route caused, in female rats only, fatty infiltration without significant cell damage. This could be prevented by simultaneous administration of methionine. Intraperitoneal injection of bromobenzene caused marked hepatic necrosis without fatty changes. This was counteracted by administration of either methionine or cysteine. These substances promoted an increase in urinary mercapturic acid excretion, which led to the conclusion that bromobenzene, by being coupled to sulfoamino-acids and excreted as mercapturic acid, produces a secondary sulfo-amino acid deficiency. Diets containing one of these three substances caused even more severe diffuse liver damage, in many instances with cirrhotic changes, and in the case of the ethionine containing diet with beginning tumor formation. When the common bile duct was ligated, cholangiolar proliferation followed by necrosis and fibrosis set in. Early dietary choline deficiency was characterized by diffuse fatty infiltration, which could be reversed rapidly by intraperitoneal administration of choline. A low protein, high fat diet resulted in marked in fatty changes, again relived by choline administration, in addition to severe cell damage, which persisted unchanged after choline injection. Feeding of a diet containing "butter yellow" caused initially mild cell damage, followed by more severe parenchymal lesions, than regeneration, and ultimately cholangioma formation.

A number of biochemical determinations was performed in liver tissue and serum of the rats, whose livers had been damaged in all those different fashions and then histologically evaluated. Of these determinations tetrazolium reduction by liver homogenate, without and with the addition of sodium succinate, proved to be the most sensitive test for liver cell damage. Without addition of substrate tetrazolium reduction measures the "endogenous" dehydrogenase activity, and with the addition of succinate the succinic dehydrogenase active. With parenchymal cell damage the reduction with and without additional substrate was markedly decreased, with regeneration and bile duct proliferation it was increased, while tumor tissue, with predominantly glucolytic metabolism, was unable to reduce as much tetrazolium as normal hepatic tissue. Decrease of esterase activity in liver homogenate and serum also was a reliable indicator of parenchymal cell damage, though less sensitive than tetrazolium reduction. In contrast to the decreased dehydrogenase activity this hydrolytic enzyme shows a tendency for increased activity in tumor tissue. It is not affected by regeneration. Increase of alkaline phosphatase activity in liver tissue and serum is a sign of damage to the parenchymal cells and also of bilary obstruction, tumor formation and regeneration. Serum xanthine oxidase activity, present in the rat, but not in humans, was diminished only in severe acute necrosis. None of the biochemical determinations mentioned until now was affected by pure fatty infiltration. Tests considerably more altered by fatty changes than by parenchymal cell damage were those of serum bilirubin and Bromosulphalein retention.

It became evident that there is no single test for the complex hepatic function. One has to depend on a "battery" of determinations and draw the conclusions from the combination of altered and normal results and from the intensity of the alterations. 155 pages. $2.05. Mic 57-1341

HEALTH SCIENCES, PHARMACY

A COMPARISON OF IN VITRO AND IN VIVO TESTS FOR THE ABSORPTION, PENETRATION AND DIFFUSION OF SOME MEDICINALS FROM SILICONE AND PETROLATUM OINTMENT BASES

(Publication No. 20,394)

Ellen Joy Plein, Ph.D.
University of Washington, 1956

The objectives of this study were to determine whether or not the results of in vitro laboratory procedures for the determination of diffusion of drugs from ointment bases would correlate with the results of in vivo testing of penetration and absorption of drugs from ointments; and also, to determine whether or not there was a difference in the diffusion, penetration and absorption of drugs from silicone ointments and from petrolatum ointments.

Three silicone ointment bases consisting of a silicone oil-wax mixture, a silicone absorption base and a silicone emulsion base were prepared. Three petrolatum ointment bases identical to the silicone ointments except that petrolatum and liquid petroaltum were used instead of the silicone oils were also prepared.

The diffusion of sulfanilamide, ammoniated mercury, salicylic acid, iodine and chlortetracycline from each of these ointment bases was studied in vitro by a modification of the agar plate method, a cylinder-plate procedure, and was also studied by the chemical agar-tube method.

The penetration and absorption of the same drugs from each of the ointment bases were compared in vivo using white rats as the experimental animals. Each ointment was applied to the dorsal skin of two groups of animals – rats whose skin was intact and rats whose skin had been abraded. The penetration of the drugs from the ointment bases into the skin was determined by analyzing a biopsy of the inuncted skin for its concentration of the specific medicinal agent and the absorption of the drug through the skin was determined by analysis of the blood or of some organ in which the drug concentrated.

Sulfanilamide concentration in skin and blood was determined colorimetrically. A colorimetric procedure was also used in analyses of skin and plasma following application of salicylic acid ointments and for the analyses of rat kidneys and skin for mercury after treatment with ammoniated mercury ointments. The penetration and absorption of iodide were determined by applying radioactive sodium iodide (I^{131}) ointments and determining the percentage of the applied isotope which was subsequently present in the inuncted skin and the thyroid glands of the treated rats. Chlortetracycline in serum and skin was determined by the microbiological cylinder-plate method.

The results of the two in vitro procedures for evaluating the diffusion of the medicinal agent from the ointment bases correlated fairly well for three of the medicinal agents and correlated slightly for the other two. When results of in vitro diffusion tests were compared with results of in vivo tests it was found that for four of the medicaments there was no correlation between the in vitro tests of diffusion and the in vivo testing of penetration through intact skin, whereas for one medicinal agent there was a slight correlation in the results of the in vitro and in vivo procedures. When penetration through abraded skin was compared with in vitro diffusion, fair correlation was shown for one medicinal, slight correlation for two others and no correlation between the results of the in vitro and in vivo tests for the remaining two drugs. Chlortetracycline was not absorbed through intact skin. There was correlation between the in vitro diffusion data and in vivo absorption data for only one of the four drugs which were absorbed through intact skin. Through abraded skin there was fair correlation of the results of in vitro diffusion and in vivo absorption methods for three medicinal agents, slight correlation in the results of tests of a fourth drug and no correlation between the diffusion and absorption tests for another. It could not be shown that either silicone or petrolatum based ointments were universally the more efficient dermatologic vehicles.

299 pages. $3.85. Mic 57-1342

HISTORY, GENERAL

AN ANALYSIS OF THE FRONTIERSMAN BASED UPON THE OBSERVATIONS OF CONTEMPORARY FRENCH TRAVELLERS

(Publication No. 19,472)

Mary Steele Owen, Ph.D.
Indiana University, 1956

The types of people who inhabited the American frontier from approximately 1750 to 1860 were analyzed according to accounts of sixty-one contemporary French travellers in an attempt to discover what importance frontiersmen had in American development. The frontier was arbitrarily defined as the region between the Appalachian Mountains and the Mississippi River and the Great Lakes and the Gulf of Mexico.

The various foreign and American frontiersmen were studied regarding both their motives for emigrating and their individual characteristics, and particular attention was given to the differences between the people settling north and south of the Ohio River. The examination of nationalities indicated that frontiersmen constituted a heterogeneous society displaying both the characteristics of empire-builders and those of fainéants.

Frontier economic life also revealed great contrasts between various westerners. The hunters who preceded other settlers often were comparatively undesirable, but exercised less influence on society, since they were continually pushed ahead of the farmers into relatively uninhabited regions. Frontier people, however, engaged in many different occupations and professions and showed considerable ability in adapting them to their needs. The pioneer was a sufficiently capable jack-of-all-trades to provide for the urgent needs of the western community. Economic life also illustrated that the pioneer was a civilized man interested in conserving valuable tradition and also able to create new things appropriate to the West.

The frontier home further substantiated the idea that frontiersmen were men of contrasts, for though their houses, food, amusements, and family life were simple, their homes often displayed ambition, industry, progress, principle, and stability. They put up with temporary discomfort in order to gain personal advancement.

The advantages and disadvantages of the frontier as a place for settlement also underlined its dual character, for while the West offered lavish benefits and opportunities it also was capable of discouraging emigrants with its many obstacles and deprivations; consequently some settlers, overcome by the difficulties of western life, became hunters, but others worked on and developed the country,

indicating that there were many intelligent, ambitious men of character on the frontier who knew what they wanted and how to get it.

The character and personality of the frontiersmen also indicated that there were men capable of developing the potentialities of the West and those who gave up in the face of hardships. The less desirable element, however, constituted a minority with which most societies have had to deal, and the weaknesses of the more desirable class naturally tended to decrease as the obstacles and hardships were overcome.

The French travellers, therefore, concluded that the frontiersman was an important historical figure responsible in part for both the spread of western civilization and the development of America which was a significant link between older European civilizations and those of the future. They also felt that the westerner not only contributed to the material development of a vast continent, but that he created a host of institutions, customs, ideas, and attitudes important to the spiritual and intellectual growth of his country. 594 pages. $7.55. Mic 57-1343

HISTORY, MODERN

THE CONTEMPORARY MEXICAN REVOLUTION AS VIEWED BY MEXICAN INTELLECTUALS

(Publication No. 20,449)

Charles Henry Haight, Ph.D.
Stanford University, 1957

This study was undertaken to determine the views of reputable Mexican authorities, as expressed in their published writings and public utterances, upon the development since World War II of the Mexican Revolution which began in 1910 and for the purposes of this study was assumed to be still in process as late as June, 1955, the terminal date for the research on this dissertation. The frame of reference was the degree of compliance by the Revolution, as implemented by the recent presidential administrations of Mexico, with the postulates and promises of that movement.

Authoritative opinions varied widely upon many aspects of the contemporary Revolution. Nevertheless, it was possible to arrive at something approaching a concensus of opinion in the majority of cases. The authorities were found to accept as desirable the chief postulates of the Revolution: popular democracy as the basic form of government, land and schools for the peasants, freedom of organization for the workers, and an abundantly producing Mexico for the Mexicans. The implementation of these postulates, however, was almost unanimously regarded as defective in a very considerable degree, in its relation to domestic politics, the Mexican economy, and the more important social problems of the country.

Administrative corruption was believed to have run rampant through almost every aspect of the Revolutionary performance, with politics and the labor movement the realms most injuriously affected. Regarding the functioning of Mexican political institutions, only the strong presidential system gave satisfaction. Some – though by no means all – of the important civil liberties were thought to be generally respected. Most notable among these was freedom of the press.

The shortcomings of the Revolution in the economic field were taken even more seriously than its political deficiencies. The economic failure was felt to be close to inexcusable. Forty-five years of the Revolution had left the Mexican masses in a condition that was still deplorable, according to all observers. Many governmental policies, it was believed, had contributed to this situation. Most expert opinion held that the agrarian reform had been inefficiently and incompletely carried out, and that the existing ejidos were in grave trouble. On the other hand, the industrialization of Mexico, admittedly encouraged by the governments in spite of their errors of procedure, was frequently regarded as promising the eventual fulfillment of the Revolutionary goals.

Many of the great social propositions and undertakings of the early Revolution were viewed as doing little better than marking time. The education of the masses was no longer an exciting crusade. The Indian problem had also suffered a sensible subsidence of interest. Church and State relationships, on the surface, were considered to be almost as cordial under the contemporary Revolution as they were acrimonious three decades ago.

Some very eminent Mexican authorities believed the Revolution to be dead, although its burial might be indefinitely postponed, for political reasons. The most frequently cited contributor to the alleged demise was corruption: "three generations of millionaire politicians assassinated the Revolution." But an equally distinguished group of authorities believed that the Revolution, with all its faults, was alive, vigorous, and full of potentialities. Economists of the younger generation were prominent among this group, which considered that the Mexican Revolution by virtue of its nature as a bourgeois movement still in its early stages would conduct the country through the evolutionary developments of an industrial revolution that would in time and inevitably, as they thought, bring about that better life for all Mexicans which the Revolution of 1910 had for its chief inspiration.

433 pages. $5.55. Mic 57-1344

SETTLEMENT AND ECONOMIC DEVELOPMENT OF THE WHITEWATER VALLEY, 1800-1900

(Publication No. 19,467)

Chelsea L. Lawlis, Ph.D.
Indiana University, 1956

This is a study in local history which is concerned with four counties in southeastern Indiana – Fayette, Franklin, Union, and Wayne. They comprise the Whitewater Valley, and this dissertation deals with its settlement and economic development in the nineteenth century.

The original census returns for 1850 show that the valley was settled largely by persons born in the Middle Atlantic States, Virginia, Kentucky, North Carolina, and Ohio. Many foreigners also migrated to this area. Most immigrants traveled through Ohio to reach the valley.

This region was one of the first places in the state to be settled, and for many years it was a leading section of Indiana in politics, agriculture, industry, and internal improvements; it was also a center of Quakerism.

The valley was explored before 1800, but the first land entry was in 1803. It filled up rather rapidly; even the War of 1812 did not stop immigration altogether. Quakers came before 1810 and developed flourishing settlements in Wayne County. It seemed that Brookville, in Franklin County, would become a large city but, instead, its fortunes changed. Richmond and Connersville became the largest cities.

Before 1850 immigration from states east and south of Indiana declined, but about this time many foreign-born came to the valley, chiefly Germans and Irish. By 1860 about two-thirds of the Germans were in Franklin County, and Wayne had the next largest amount. Wayne had about one-half of the Irish.

Inhabitants of the valley participated actively in road, canal, and railroad-building projects. Numerous state roads and turnpikes were constructed and several stage lines served the area. The people contracted "canal fever" and completed at least one canal, the Whitewater, which had been commenced by the state. It was not successful. Eleven railroads were built in the valley.

Because the valley was settled early and much of its soil was fertile, it became important agriculturally. Valley farmers often captured the lion's share of premiums at the Indiana State Fairs before the Civil War. There was also lively interest in agricultural societies.

Franklin and Union counties have remained essentially agricultural to this day. Fayette and Wayne have enjoyed considerable industrial prosperity, which began after the Civil War. In value of manufactured products Wayne led the state in 1860; however, by 1900 it was no longer in the first ten counties. Connersville, in Fayette, was an important center for the manufacture of furniture, vehicles, and clothing. Richmond, in Wayne, was noted for its agricultural implements, lawn mowers, pianos, burial coffins, and numerous other items.

Finally, the valley is significant because of the many leaders it produced. Several political leaders, including congressmen, governors, and cabinet members, were either born there or lived there. Educational, literary, scientific, and military leaders also came from the valley. The fact that so many outstanding personalities were produced there is further proof of its importance.

373 pages. $4.80. Mic 57-1345

THE ACADEMIC CAREER OF WILLIAM E. DODD

(Publication No. 20,267)

Lowry Price Ware, Ph.D.
University of South Carolina, 1956

The puritan simplicity of his family and the agrarian democracy of his Clayton, North Carolina home shaped the boyhood of William E. Dodd. His mother nutured his early interest in history. At Virginia Polytechnic Institute he came under the influence of Edwin Sheib who induced him to study for a doctorate in history at the University of Leipzig. Karl Lamprecht and Erich Marcks were his major professors, and in 1899 he completed his doctoral dissertation, "Jefferson's Ruckkehr zur Politik, 1796." The following year he became professor of history at Randolph Macon College in Ashland, Virginia.

In eight years at Randolph Macon, "Monk Dodd," as he was known on the campus, achieved extraordinary success as a teacher who inspired numerous capable students to seek graduate training. He launched his historical writing with an immature, but promising biography of Nathaniel Macon, edited a monographical series entitled The Branch Historical Papers, and contributed scores of book reviews and articles to the New York Times, the American Historical Review, and other journals. His biography of Jefferson Davis in 1907 won him the acclaim of such men as James Ford Rhodes and Frederick Jackson Turner, luncheon with President Theodore Roosevelt, and an appointment as professor of American history at the University of Chicago.

For the next quarter century Dodd taught and worked at Chicago. He added new courses in Southern and Western history, assembled source collections for research in those fields, and attracted hundreds of students. He became known as a great teacher who embodied a rare combination of simplicity of manner with a deep devotion to learning. He guided the work of a score or more of students who became leaders in the profession. In addition to becoming head of the History Department, he achieved wide influence in University affairs.

For a variety of reasons Dodd's written output never equalled the quality of his teaching. The first and last publications of his Chicago years, Statesmen of the Old South (1911) and Lincoln or Lee (1927), were popular biographical essays which attracted less critical and scholarly acceptance than his two studies of ante-bellum America, Expansion and Conflict (1915) and The Cotton Kingdom (1919). An unsuccessful essay into contemporary history in 1919 with a biography of Woodrow Wilson and an unfinished "History of the South" ended his career on a note of failure.

Within the fraternity Dodd won a wide reputation as "a revisionist" and a New Historian who emphasized the importance of democracy and economic sectionalism. He was also a member of the younger, liberal generation which wrested control of the American Historical Association from the traditionalists, and in 1934 he served as its president. In addition to his close contacts with scores of fellow academic historians, Dodd served as critic and advisor for many non-academic or literary historians.

From 1911 to 1933 Dodd played an increasingly important, if minor, role in Democratic party politics. During the Wilson administration he served as speech writer and adviser, and in the twenties he spoke out frequently for international cooperation and agricultural reforms. His greatest political effort was his support of Franklin D. Roosevelt in the election of 1932, and the following year President Roosevelt selected him as American Ambassador to Hitler's Germany. Dodd's divided interest in the academic world and the field of public affairs was finally resolved in favor of the latter.

342 pages. $4.40. Mic 57-1346

FACTORS AFFECTING FARM FAMILY GOALS

(Publication No. 19,413)

Emma Grace Holmes, Ph.D.
Purdue University, 1956

Major Professor: Cleo Fitzsimmons

The setting of goals is an important step in the process of management. Goals held by farm families are of interest to workers in programs providing these families with assistance in management problems. The purposes of this study were to learn the extent to which families recognize and can express their goals; to examine the relationship of such factors as stage of the family cycle, income, and tenure to the nature of family goals; and to develop methods by which these relationships may be analyzed.

Tipton County, an outstanding agricultural county of Indiana, was the locale of the study. Data were obtained by personal interview from 70 farm families in the spring of 1955. To be eligible for interview, a family must (1) operate a farm on a full-time basis, obtaining the major part of its income from farming; (2) be headed by a man not over 50 years old; and (3) have one or more children. Families were selected mainly from among members of Extension clubs, and included 20 in the preschool stage of the family cycle, 25 in the grade school, and 25 in the high school stage. These 70 families make up the population of the study. Eight were full owners of their farms, 31 part owners, and 31 tenants. Families reporting net incomes in 1954 of $1,500-$4,999 were classed as low income, those reporting $5,000 or more as high income families.

Information about goals was obtained by the use of open-end questions relating to goals in six areas – family, farm, financial, housing, household facilities and equipment, and community participation and recreation. Most of the data were obtained from the homemakers, although the husbands also took part in about half of the interviews.

Goals for education of children were generally (1) to have them graduate from high school, and (2) to help them obtain further education if they chose to go on. Farm ownership was a goal of all tenant families, though only half of them reported progress toward the goal. Two-fifths of all families expressed a goal of increased acreage for farming. Most families had goals for saving. Purposes for saving varied among stages of the family cycle. For most preschool families, increasing participation in community activities was a goal; in other stages of the cycle the goal was more frequently to continue the present level of activity.

A five-point scale was developed for scoring goals expressed by the families, to facilitate description of groups of related goals and comparisons among groups of families. For a group of related goals, the higher the score the more definite the expression of or action toward the goals, or the larger the number of achieved goals.

Average family score for education goals increased as stage of the family cycle progressed; the reverse was true for health goals, for which preschool families had highest score. Preschool families were slightly lower than others on average score for farm goals (mainly due to low scores on ownership) and on financial goals. The three stage-of-cycle groups had about the same average score for household facilities and equipment. Almost all families scored about the middle score for this group of goals, indicating a high level of attainment of conveniences for the home. Preschool families scored lower than others on community participation goals, but higher on recreation goals. High income families scored slightly higher than low income families on many goals.

The families thought more clearly in terms of the relatively short-time goals than the long-time ones. Thirty-three families mentioned a time five or more years hence when they expected to attain a goal they were working toward, but usually with uncertainty. Time of attainment of long-time goals was frequently described in terms of age of the children in the family.

The families differed considerably in their ability or willingness to express their goals. In general, goals of the 70 families had many similarities, as might be expected in a group of families who have many characteristics in common, who are in close contact with each other.

The open-end questions used did not prove entirely suitable as a device for obtaining data that could be relied upon to establish an objective, definite score. More specific information was needed for determining goal attainment for some items. 183 pages. $2.40. Mic 57-1347

A STUDY OF THE IN-SERVICE EDUCATION NEEDS OF HOMEMAKING TEACHERS IN DELAWARE

(Publication No. 17,659)

Ruth Mitchell Laws, Ed.D.
New York University, 1956

Chairman: Professor Louise Fernandez

The recognition of the need for continual attention to the professional improvement of teachers is a modern educational concept. It is imperative that the teacher of homemaking continue to improve professionally since social and technological changes taking place in American society have immediate bearing on her field. The underlying purpose of this study was to make a contribution to the in-service education program for the professional improvement of homemaking teachers in Delaware.

Because there is diversity in the problems related to in-service education confronting homemaking teachers in Delaware, it was necessary to make a survey of the need for professional improvement. Five specific objectives were set up to guide the study: (1) to analyze the status of

in-service education of the homemaking teachers, (2) to determine the extent to which these teachers are participating in the present program, (3) to discover the factors limiting participation, (4) to determine the types of courses and activities which homemaking teachers consider helpful in meeting their professional needs, and (5) to formulate recommendations based on the data for a comprehensive program of in-service education.

In order to secure information regarding the nature of the homemaking teachers' needs, and the extent of in-service education for homemaking teachers within the state, the normative survey method was employed. Questionnaires were sent to seventy-two homemaking teachers and twenty-five school administrators. Personal interviews were conducted with teacher trainers from the two state teacher training institutions, with the state and city supervisors of homemaking education, and with the state certification and record office personnel. The period studied was September 1954 to January 1956.

Findings on the status of in-service education of homemaking teachers reveal that the chief sources of in-service education are summer courses at the university and the services of the State Education Department, including class visitation, conducting professional meetings and curriculum studies. Graduate work at the university makes possible the earning of advanced degrees in the areas of (1) homemaking education and (2) general home economics. With a small staff, the University has generally been able to only offer extension courses on the campus and in the city of Wilmington.

More than fifty per cent of the State teachers indicated that family responsibility prohibits their studying for advanced degrees. A majority of the teachers hold membership in the State Home Economics Association. Comparatively few of them are members of the Vocational Association. The majority of teachers attend the State professional meetings. However, a few teachers seldom attend these meetings.

Factors limiting participation in in-service work were found to be family responsibility, cost, travel, distance and lack of time.

Professional needs listed most frequently by the teachers were, improved teaching methods in line with current practice and a better understanding of family centered teaching. Services considered most valuable were practical technical demonstrations on the field, and frequent teachers meetings in their area. The most popular activities for credit were (2-3 weeks) workshops on the campus and workshops in the teacher's area of the state.

General conclusions about an in-service education program for homemaking teachers in Delaware were reached as follows:

1. The University has an opportunity to broaden its services in off-campus, in-service work for homemaking teachers.
2. In-service education centers for home economics teachers need to be established in three areas of the state in order to give teachers an opportunity to work on practical problems near the local setting.
3. Sound leadership in in-service education calls for cooperative planning by all those concerned with the program.
4. A contribution to in-service growth would be made through the development of research and information services for homemaking teachers.

191 pages. $2.50. Mic 57-1348

JOURNALISM

A CRITIQUE OF THE STATUS OF JOURNALISM IN AMERICAN PUBLIC SECONDARY SCHOOLS

(Publication No. 17,569)

Donald Ray Grubb, Ed.D.
University of Utah, 1956

Chairman: Paul C. Fawley

The problem. The problem was an investigation of two aspects of journalism education in American public high schools. The purposes of the study were: (1) To determine the status of the high school journalism course, and (2) To analyze the training and preparation of the journalism teacher.

The method. The evidence in this work was secured by the following methods: (1) Historical, (2) Normative Survey, (questionnaire), and (3) Personal correspondence and interview.

Sources of data collected are divided into two classifications: (1) Primary, and (2) Secondary. Primary data consisted of responses from two independent sets of questionnaires, interviews, and correspondence. Secondary data were collected by means of library research.

Conclusions. The number of schools offering journalism has gradually increased. Along with this growth has come a fuller recognition, but not realizations of journalism's potentialities towards meeting the needs of a greater number of youth within the individual school.

Journalism is tending to become a curricular course, independent of former English course ties. A growing number of teachers with specialized backgrounds other than English are conducting journalistic activities in the school. The supervision and production of school publications continue to be a major function of the journalism course.

School administrators have generally recognized the expressed and inherent values of school journalism, but have been less willing to carefully select well-trained and qualified teachers for the journalism assignment.

Subject matter presented in the instructional program of secondary school journalism is strongly oriented to a stress on technical journalistic skills. An insignificant amount of time is devoted to an understanding of the social significance of journalism and the mass communications media.

Areas of study stressed in the classroom tend to contradict what most teachers think should be taught. This

contradiction is attested by the high ratings given to course objectives which aim to create a better understanding of the mass media's role and influence in our society.

The journalism teacher has gained appreciable responsibilities in the schools' public relations programs.

Teachers of the subject have characteristically been trained in areas other than journalism. Likely he has had a limited background in journalism at the college level, but for the most part, this experience has been confined to a study of journalistic techniques.

On the whole, the journalism teacher has not been satisfied with his limited college journalism experiences, but he has little constructive criticism to offer.

Opportunities for teacher preparation were found limited. Few colleges and departments of journalism have seriously acknowledged a responsibility for providing special programs for the high school journalism teacher, and existing programs show little or no adaptations to needs of the prospective teacher.

There is no pronounced agreement on the part of journalism school educators as to the extent problems of the journalism teacher should be recognized in the journalism curriculum, although there is some common agreement as to what the objectives for the high school course should be. There appeared to be no basic philosophical differences in the way journalism school administrators rated high school objectives for the course, and the way teachers in the classroom rated them. 339 pages. $4.35. Mic 57-1349

LANGUAGE AND LITERATURE, GENERAL

FRENCH CRITICISM OF GEORGE ELIOT'S NOVELS

(Publication No. 20,504)

John Peter Britz, Ph.D.
University of Minnesota, 1956

Adviser: James T. Hillhouse

The considerable body of French literary criticism of George Eliot's novels offers some insights and theories not encountered in English or American criticism. The French critics who have spoken with taste, imagination, and authority on George Eliot – Montégut, Brunetière, Scherer, Mme Madeleine Cazamian, Charles Du Bos, and Mme Irène Simon – are probably not well known outside France, whereas Taine, the best-known nineteenth century French critic, has little to say about George Eliot. Montégut's analysis of the Protestant origins of English realism, Mme Cazamian's painstaking analysis of the sources of George Eliot's ideas, Du Bos's identification of the Bergsonian elements in the novels, are thorough, competent, and imaginative studies which repay careful reading. Other lesser-known critics, whose work is on a smaller scale – Thibaudet on the Bergsonian ideas adumbrated in George Eliot – are rewarding, but much of the work of the minor critics and literary historians, is superficial, obvious, repetitive, or generalized to the point of harmless neutrality.

French criticism of George Eliot tends to be personal and impressionistic, seeming to lack absolute or objective critical standards which all critics can hold as common ground. Various French critics compare and even rank George Eliot with Goethe, Shakespeare, Dickens, Flaubert, Balzac, Charlotte Brontë, and George Sand; Melchior de Vogüé compared her realism with that of the Russians – Tolstoi, Turgenev, Dostoyevsky. The critical commonplace most often reiterated by the French critics is that not excessive intellectuality nor deficient imagination, but rather an abounding intellectuality which sometimes operated at the expense of imagination, was the cause of her decline in popularity. Although the early critics praise mainly the first four "rural" novels, rejecting the last four "idea" novels as being slow and encumbered with ideological and philosophical digressions, more recent critics have increasingly discovered excellences in Felix Holt, Middlemarch, and Daniel Deronda, although Romola has never been able to win many admirers.

Aside from Montegut's analysis of Adam Bede and Mme Irène Simon's analysis of Middlemarch, there is little exhaustive literary criticism of specific novels, and the art of fiction is not often discussed in concrete or analytical terms. The French critics seem little concerned with form and structure, and other literary technical matters such as theme, metaphor, irony, diction, style, and rhythm are seldom discussed. Along with Dickens and Shakespeare, George Eliot is recognized as one of the great creators of characters which have all the diversity, complexity, and inconsistency of living people, in addition to that color and eccentricity which makes them unique. The early critics admire chiefly the accuracy of the first-hand observation of the rural characters, but recent French criticism recognizes the truth to life of the harder-surfaced, more egotistical characters – the Transomes, Gwendolen Harleth, Grandcourt. Her weakest characters are now seen to be those whom she sentimentalizes or in whom she idealizes herself.

The French critics hail George Eliot as a novelist of ideas rather than as a great literary technician; two important writers, Mme Madeleine Cazamian and Bourl'honne, are concerned with showing the origins and tendencies of George Eliot's ideas, but there is general recognition that she is primarily interested in using the novel to discuss and clarify her attitudes on moral problems. Scherer, Brunetière, Montégut, and Du Bos feel that this was the wisest course for a writer of her taste and temperament, since she fits so exactly into the main tradition of the English novel, concerned with moral problems and the complexities of the human consciousness.

279 pages. $3.60. Mic 57-1350

SHAKESPEARE'S THE MERRY WIVES OF WINDSOR: A HISTORY OF THE TEXT FROM 1623 THROUGH 1821

(Publication No. 20,349)

Elizabeth Brock, Ph.D.
University of Virginia, 1956

Recent studies of the treatment of Shakespeare's text by seventeenth- and eighteenth-century editors, e.g. Black and Shaaber's Shakespeare's Seventeenth-Century Editors and Ronald B. McKerrow's "The Treatment of Shakespeare's Text by His Earlier Editors, 1709-1768," have been based on surveys of the editing of all of the plays and have stated in general terms the main lines of the development of early editorial theory and procedure. It is the purpose of the present study to trace the text of a single play, The Merry Wives of Windsor, through the first two hundred years of its editorial history, from the Second Folio (1632) through the Boswell-Malone Variorum (1821). The text as it appears in the First Folio has been fully collated with that of every important edition between 1632 and 1821, in an effort to determine as precisely as possible the procedure of individual editors.

Part I of this study consists of a detailed description of the text of The Merry Wives as it appears in the First Folio, a description designed to establish the state of the text as it was transmitted to the early editors. Emphasis is placed upon those features of the text that call for editorial decision: evidence that the Folio text was set from a transcript by Ralph Crane of Shakespeare's foul papers; the erratic lineation of obvious prose passages as if verse were intended; the inconsistent representation of the dialects of the Welsh parson and the French doctor, as well as of a few passages of Latin and French; the obvious corruption of the text, including certain inconsistencies of fact or action; and the real or fancied lacunae in the text to which the corresponding readings of the "bad" quarto of 1602 supply clues.

The main body of the study, Part II, consists of an examination of the treatment of the text of The Merry Wives by the editors of the seventeenth and eighteenth centuries, up through the Boswell-Malone Variorum of 1821. Appended to this section are seven lists of visual collations, recording all significant emendations made in the text during these years. The emendations are classified according to seven types: corrections of obvious scribal or compositorial errors in the F_1 text; unintentional changes repeated in subsequent editions; metrical emendations; emendations of dialect or of passages in foreign languages; "improvements" of grammar or diction; substantive verbal emendations; and substantive emendations of punctuation. The discussion of each editor's work is based upon a comparison of his prefatory statement concerning his editorial theory and procedure with the evidence from these lists as to what he actually did in editing the text. Throughout this part of the study, the writer's primary concern has been to analyze and record the effect upon the text of The Merry Wives of the erroneous theory and practice of early editors, and to trace the evolution, during the latter half of the eighteenth century, of a somewhat sounder editorial attitude. Particular attention has been devoted to the influence of four faults of early editors: the unfortunate practice of basing each new text upon that of a recently printed edition, with the consequent perpetuation of the accumulated errors of all preceding editions; the unreasoned eclecticism that led to unwarranted use of even so obviously "bad" a quarto as that of The Merry Wives; the unlicensed "improvement" of Shakespeare's metrics, syntax, and diction; and an equally unlicensed freedom in conjectural emendation. 623 pages. $7.90. Mic 57-1351

INNOCENCE REGAINED: SEVENTEENTH-CENTURY REINTERPRETATIONS OF THE FALL OF MAN

(Publication No. 20,053)

Anne Elizabeth Davidson, Ph.D.
Columbia University, 1956

The Preface discusses the importance of the doctrine of the Fall of man for the seventeenth-century – its central position in the thought of the period and its popularity as material for poetry. It explains the focus of the study upon reinterpretations of the Fall emerging among Anglicans and moderate Puritans and the effect of these ideas on Anglican poets.

The Introduction suggests the significance of the reinterpretations of the Fall for a reading of seventeenth-century lyric poetry; the aesthetic ideals of George Herbert, Henry Vaughan and Thomas Traherne are discussed. The shift from emphasis on limitation, moderation, restraint, ideals in art as in behavior to the early seventeenth century, to post-Restoration enthusiasm for the boundless and the infinite, is related to the change in attitude toward the nature of man, the growing conviction that man was born good, even since the Fall, with infinite capacity to fulfill this goodness.

Chapter I is a brief historical discussion of the tradition of the doctrine of the Fall inherited by seventeenth-century Englishmen. The survey stresses the importance of St. Augustine in the tradition but begins with Genesis and traces biblical, patristic, scholastic and reformation interpretations of the Hebrew text which were particularly familiar to Anglicans of the period. It indicates the widespread acceptance in the late sixteenth century of the interpretation of the Fall of man which Luther and Calvin found in St. Augustine.

Chapter II shows how Englishmen of the early seventeenth century, in keeping with their melancholy view of nature and history, deepened the pessimistic aspects of the Reformation doctrine of the Fall which earlier Anglicans had inherited from St. Augustine. Herbert and his fellow churchmen – Donne, Laud, Andrewes, Hacket, Hall, Brownrig, Cosin, Ferrar – provide examples of the reading of Adam's story accepted in the first decades of the period.

Chapter III presents Jeremy Taylor and the Great Tew Latitudinarians as the first group to revolt against Augustinianism in favor of a kind of Pelagianism, the first to reinterpret the doctrine of the Fall optimistically by viewing it in the light of Greek patristic thought, Renaissance humanism and current Arminian theories. The Latitudinarians were also among the first Englishmen in the seventeenth century to suggest that wicked custom and example, wicked education corrupt man more surely than his inheritance from Adam.

Chapter IV analyzes seventeenth-century theories of pre-existence as another attempt to reinterpret the doctrine of the Fall in such a way as to allow for a more hopeful view of man's nature and destiny than official Anglicanism implied. Such theories were held by Henry Vaughan and his brother Thomas, Henry More, Glanvill and Rust. Like the Latitudinarians, these writers implied that in this world man's earliest purity is lost, even since Adam's Fall, but that the soul is a "ray" of the divine light which, though it can be dimmed, can never be sundered from God.

Chapter V compares with believers in pre-existence those writers who reinterpreted the Fall of man to make room for the idea of progress. Henry More is again discussed, here in connection with Thomas Burnet and other students of science and Scripture whom Ernest Tuveson had analyzed from a different point of view in his Millennium and Utopia. Burnet was the first Englishman to suggest that the legend of the Fall was a parable invented for ignorant Jews but long since outgrown by philosophical Christians. Viewing the Fall as the slow decline of society through many generations, not an inner corruption inherited by each man at his birth, Burnet saw progress as a possible, indeed inevitable and already at work, in human history.

Chapter VI discusses the triumph in the late seventeenth century of a Pelagian interpretation of the Fall which read the historical event as a psychological lapse in the life of each man, the effect of evil custom and example defiling original innocence. Traherne, the central figure in the chapter, is compared on the one hand with his Platonic contemporaries, on the other with such scientific divines as Sprat, Frank, Patrick and Barrow.

328 pages. $4.20. Mic 57-1352

THE ARTIST'S YEAR: A STUDY OF THE MEANING OF TIME IN THE LIFE AND WORKS OF WILLIAM BLAKE

(Publication No. 20,233)

Stanley Kenneth Freiberg, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Helen C. White

The intention of the work is to give a detailed explanation of William Blake's theory of time, and to investigate his personal application of the theory.

The development of the three fundamental ideas which make up the time concept is traced briefly in the introduction. These ideas, analyzed in the early chapters, are: (1) the theory of contraries, which, as applied to the time theme, is the assertion that a life in time aids in the understanding of eternity; (2) the idea of the circle of destiny, namely, that this world proceeded from eternity and will rejoin eternity upon the completion of a six-thousand-year cycle; and (3) the theory of the eternal now, which proposes that man, through imagination, can experience the eternal while living in this world. The position arrived at through fusing these three ideas is the fundamentally Hellenistic one that eternity is presently perceivable reality, and time is a passing illusion.

Blake's depiction of Time as a young man in eternal youth is found to grow logically from his basic conception; and the difficulties in retaining this vision of Time due to the power of reason and memory are pointed out.

The necessity of redeeming time, which is a fourth idea basic to Blake's over-all concept, is treated at length. This idea, though inseparable from the fundamental concept, touches more directly upon its application than its formation. The need to redeem time exists because the works done in this world are seen as enlarging one's vision in eternity; and because the individual is construed to be continuously undergoing a judgment which places him in association with either the material or the spiritual. The individual can ally himself with the spiritual, according to Blake, by working in an artistic medium. The poet sees the same faculty at work in the arts as that which reveals the reality of eternity; therefore, he maintains that the method of redeeming time is to practice the arts and to bring others to their practice.

The adoption of the Christian idea that time must be redeemed, complicates Blake's basically Hellenistic theory: time, which is known to be illusion, must be treated as real. But Blake felt that in Christ he had discovered an outstanding example of an individual who was able to live compatibly in this world while understanding it to be illusion; as a result, Christ becomes, for Blake, the epitome of imaginative or artistic experience, effecting the reconciliation of time and eternity.

Blake's difficulties in reconciling himself to an illusory existence are the chief matter of the final portions of the work. His three-year stay at Felpham from 1800-1803, during which he tried to meet the demands of this world while writing visionary works thought of as portions of eternity, is the chief period covered. However, those occasions upon which this problem becomes crucial in later years are also treated. The formulation of the theory of the artist's year is one such case; Blake, in 1809, tried, in maintaining that no work of art can take longer than a year, to make society understand his idea of time by juxtaposing it with the common view.

The work concludes that Blake fused Hellenistic and Christian elements in constructing an intellectually compelling theory which he found difficult to apply.

164 pages. $2.15. Mic 57-1353

SHAKESPEARE IN UTAH

(Publication No. 17,574)

Leland Hans Monson, Ph.D.
University of Utah, 1956

Chairman: Harold Folland

This study of the place of Shakespeare's works in a distinctive culture built in the Rockies has undertaken to determine how extensive it was and to suggest the nature of the influence Shakespeare exerted on pioneer life, thought, and feeling. It has shown that Shakespeare played a part in that culture in four different ways – in productions of his plays, in reviews of these productions, in articles as well as quotations from and allusions to his works in magazines, and in courses of study in schools.

Though presented in Utah as elsewhere in adapted

versions and cut to please the tastes of spectators and the exigencies of the stage, the plays were performed, in the main, in a creditable manner. The acting, generally, was done by fairly well-trained actors and actresses of the Deseret Dramatic Association, volunteers from various walks of life, and by traveling troupes, including some of the most gifted artists of the period such as Edwin Booth and Mary Anderson. Many good ensemble productions were given by combinations of the local company with guest stars in such plays as Julius Caesar, Romeo and Juliet, The Merchant of Venice, and Macbeth, though, of course, there were instances where minor roles were badly presented. Performances by the local stock company of an occasional history or tragedy, though not equal to productions by the leading traveling troupes, were well received by Salt Lake theatre-goers, who were not blind to the deficiencies of the players. Indeed, many of the local performers achieved a high degree of excellence. The opportunity to act with and learn from great stars was particularly valuable in productions of plays as difficult as Shakespeare's. The costumes, scenery, and stage properties were frequently highly artistic and depicted accurately the physical and social milieu of the plays. Music accompanied the performances and at best formed an integral part of them.

The reviews printed in the Deseret News and the Salt Lake Tribune, which were focused primarily upon acting, scenic representations, reading of the lines, and music, directed readers to artistic details that otherwise might have escaped their attention. Moreover, the reviewer's frequent comparisons of one player's interpretation of a role with another's offered insight into Shakespeare's art of projecting characters into action as well as into principles of histrionic interpretation. They emphasized, too, the qualities of performers' readings of choice poetic passages, suggesting the importance of subtle aesthetic and ethical values in them.

Writers in the Woman's Exponent and the Contributor, unlike the reviewers, reflected a broadly general interest in Shakespeare in articles about his life and environment and the characters in the plays, especially female characters, in whom moral issues are often most plainly discernible. They also alluded to the plays and quoted from them frequently in order to enrich and enforce their ideas concerning Mormon doctrines, social problems, and moral qualities. Their attitude strongly suggests that the pioneers turned to the plays quite as much for guidance in righteous living as for entertainment and artistic pleasure. To them Shakespeare was a teacher of moral wisdom.

The schools, too, probably did something to develop an intelligent appreciation of Shakespeare's works. The students who used the Rolfe and Hudson editions of individual plays had an opportunity, during their formative years, to refine their literary tastes and to grasp some of the intellectual and spiritual implications of Shakespearean drama.

We may infer that Shakespearean influence from these four sources tended to discipline the minds of the pioneers, to mature their emotions, and to make them less provincial than they otherwise might have been. Equipped with a common body of knowledge about his plays and with methods of producing them, these people had their attention directed in part away from mundane affairs towards aesthetic and spiritual conceptions which tended to broaden their intellectual horizons. In the plays they saw, among other things, the folly of self-love, the curse of inhumanity, the tragedies of bad intention and of good intention twisted to evil ends, and the unhappy result of unrestrained ambition, of indecision, and of jealousy. Shakespeare, then, came before the pioneers not only as entertainer but also as spiritual mentor, and apparently he appealed to them over the years in this dual role. That Shakespeare, in short, occupied much the same place in the culture of this Western frontier community that he did in the long settled urban centers of the East, suggests that frontier life, however primitive physically, was not so lacking in the literary graces as some critics have contended.

322 pages. $4.15. Mic 57-1354

CHAUCER, GOWER, AND THE ENGLISH RHETORICAL TRADITION

(Publication No. 20,460)

James Jerome Murphy, Ph.D.
Stanford University, 1957

I have re-examined the evidence presented over the last three decades in support of the thesis that Chaucer and Gower followed the precepts of medieval rhetoricians.

Evidence as to the existence of an active tradition of rhetorical learning in fourteenth-century England seems to be very sparse. That is, English writers of this period apparently followed foreign models in composing artes praedicandi, but produced no theoretical manuals of dictamen prosaicum until the following century. Aristotle's works, especially the Topica and De Sophisticis Elenchis, apparently replaced rhetoric at the university level, whereas lower schools relied upon grammatical works like the Graecismus of Evrard of Bethune and the Ars Minor and Barbarismus of Donatus. My examination of library records and literary references revealed a similar lack of interest in rhetoric and its derivatives. On the other hand, French concern for rhetoric during the fourteenth century furnishes a revealing contrast. Operating in a tradition extending as far back as the previous century, French poets and critics discussed rhetoric in their literature besides composing theoretical vernacular treatises. On the basis of such data, there would seem to be slight reason for accepting the thesis that an English rhetorical tradition existed during the fourteenth century.

My examination of Chaucer's education, his use of rhetorical terms and figurae, and his possible links with ars poetria leads to the conclusion that he could have derived his so-called "rhetorical" training from the ordinary grammatical texts of his day. It is possible that he attended a grammar school, perhaps St. Paul's in London, where he could have studied French, scholarly Latin, grammatica, dialectica, musica, and other subjects. His works display no technical knowledge of rhetoric, but indicate only a layman's acquaintance with the fact that such a subject existed. His supposed borrowings from Vinsauf are not conclusive evidence that he ever read that author's Poetria Nova, especially since the bulk of alleged borrowings could have been taken from a work by Nicholas Trivet, a fellow Englishman. Although various writers have identified a large number of figurae in Chaucer's works, he could have learned these figures either from the ordinary grammar texts or from the French poetry he is known to

have read. Significantly, no modern scholar has been able to establish a clear connection between Chaucer and a manuscript of Vinsauf. Every library catalogue of the period, however, lists copies of Barbarismus or Graecismus which treat the very figurae he is supposed to have learned from Vinsauf. Indeed, it might be more proper to say of Chaucer that he takes part in a grammatical tradition, not a rhetorical tradition.

The same might be said of Gower, despite the fact that his Confessio Amantis contains the first known discussion of rhetoric in the English language. Suggestions that Gower derived his knowledge of figurae from Vinsauf rest on very tenuous grounds, for like Chaucer he had access to the standard grammatical texts and the popular French poets. Gower indicates no other knowledge of rhetoric or its derivatives. His extremely vague discussion of "Rethorique" in Confessio Amantis VII reflects his ignorance of the subject more than his knowledge of it, for he apparently takes its general outlines from Brunetto Latini's Tresor without retaining the essential doctrines. There is consequently no reason to believe that Gower operated in a rhetorical tradition.

In light of these conclusions concerning Chaucer and Gower, it might be fruitful to re-examine the assumptions now currently made concerning the education and reading habits of other English literary figures of the Middle Ages.

320 pages. $4.10. Mic 57-1464

LANGUAGE AND LITERATURE, LINGUISTICS

A VOCABULARY STUDY OF SKEAT'S EDITION OF THE A-TEXT OF PIERS PLOWMAN

(Publication No. 19,492)

Clyde Murrell Grant, Ph.D.
The University of Oklahoma, 1956

Major Professor: Rudolph C. Bambas

During the fourteenth century the vocabulary of the English language was undergoing rapid and extensive changes. Many French words were being added to the word-stock, and a great number of Old English words were going out of use. The fact that Piers Plowman, one of the most popular poems of the fourteenth century, was addressed to the common people of England makes it seem probable that the vocabulary of the poem was quite similar to the speech of the people who were to hear it. Since Piers Plowman was widely imitated, and since its influence lasted well into the sixteenth century, it seems likely that the poem may have had some influence on the modern English vocabulary.

In order to facilitate an examination of the vocabulary of Piers Plowman, a concordance to the A-text of the poem was made. The etymologies of all the nouns, verbs, adjectives, and adverbs were then determined by use of the New English Dictionary and other etymological dictionaries. Comparisons of the vocabulary of Piers Plowman with the vocabularies of other writings of the same period were made in order to discover similarities and differences between the words used in Piers Plowman and the vocabularies of other poems of the fourteenth century.

The vocabulary of Piers Plowman was found to be similar in distribution of word origins to other poems written during the same period. Chaucer's poetry, even though it was addressed to a more aristocratic audience than was Piers Plowman, was found to be quite similar to Piers Plowman in distribution of word origins.

According to the New English Dictionary many modern English words, especially words having to do with the activities of the common people, were first used in literature in Piers Plowman. A comparison of the vocabulary of Chaucer with the words used in Piers Plowman revealed that Piers Plowman contained a great number of words that were not used by Chaucer in any of his writings.

Since a significant number of modern English words were first used in literature in Piers Plowman, and since many words that survive in modern English were used in Piers Plowman and were not used by Chaucer in any of his writings, it seems probable that Piers Plowman had an important influence on the modern English vocabulary.

645 pages. $8.15. Mic 57-1355

LANGUAGE AND LITERATURE, MODERN

A STUDY OF CERTAIN LEGALLY BANNED NOVELS IN THE UNITED STATES, 1900-1950

(Publication No. 20,273)

Max Bogart, Ph.D.
New York University, 1956

Chairman: Professor Charles A. Siepmann

Statement of the Problem

The problem was to investigate what novels of importance were legally banned in the United States from 1900 to 1950, on what grounds, the forces involved, the court decisions and their acknowledged influence, and the trends in literary censorship. Except for federal agency and state bannings, this study was limited to major cities.

Procedure

The general procedure was to describe book banning from 1900 to mid-century. A complete list of legally banned novels was compiled. This was followed by an examination of those individuals and groups who favored or supported literary censorship to determine real or admitted pressure and to analyze the reasons. The court decisions were analyzed and any acknowledged influence on literary and artistic expression was noted. Finally, the study examined book banning trends.

Summary of the Findings

The problem of book banning is involved, prevalent, and controversial. These questions remain unanswered: What is censorable? Who will be the censor? Where is the line to be drawn between liberty and license?

The focus of suppression has shifted to morality,

delimited to mean obscenity by abstract statutes, which reveal a semantic confusion, and, therefore, are difficult to interpret and to apply.

Until 1933 the courts generally tested a book's obscenity by its isolated passages and its effect on certain readers. Following the Ulysses decision a modern test was applied which holds that a book must be judged in its entirety. Its accepted position in the world of letters must be considered, competent critics may offer testimony; and the book's effect on potential readers must be determined.

The trends in legal book banning are significant for a pattern has emerged which may be described as a series of liberalizing effects. Certain enlightened decisions are indicative of modern sociological jurisprudence for they translate the current mores into the law; these decisions have brought about an increased liberalization of the printed word and a creative atmosphere where discussion of certain human activities, especially the sexual, are not subjected to the process of circumlocution. Customs, since 1930, has attempted to establish a fair method in the handling of imported books. The Post Office has suppressed relatively few books. The recognized classics are not hindered by the courts, Customs, or the Post Office. The volume of indictments by the vice societies has diminished. At mid-century no major city permits a censor to decide a book's fate.

Compared to the nineteenth century the number of prosecutions has been slight and the number of convictions since 1933 is almost negligible. Generally, literary censorship was not upheld legally.

Near mid-century certain racial, religious and patriotic minority groups have attempted to suppress allegedly offensive or dangerous books. These groups have created an informal censorship. No legal intervention occurs; thus the judicial process is circumscribed.

Acting on behalf of individuals or pressure groups, the police in certain communities often constitutes an extra-legal, if not illegal, form of censorship.

It was concluded that literary censorship is irrational; that the banning of books usually defeats its avowed aim; that censorship raises serious questions regarding the principle of freedom of expression in a democracy; and that no remedial plan has been suggested to satisfy those parties concerned with this area of civil liberties.

501 pages. $6.40. Mic 57-1356

RELATIVITY IN THE NOVELS OF VIRGINIA WOOLF

(Publication No. 20,595)

Carl Frey Constein, Ed.D.
Temple University, 1957

A possible explanation for Virginia Woolf's continuing popularity among serious readers of fiction is that her novels convey a remarkable sense of relativity. Although the body of criticism on Mrs. Woolf at places touches indirectly upon this general concept, heretofore there has been no attempt to postulate the fluidity of modern life as a central concern of her fiction. Virginia Woolf was aware of the important ideas from the three sciences most responsible for the loss of absolutism – physics, psychology, and biology.

Numerous passages in Mrs. Woolf's novels suggest the loss of fixity which results from such theories of the new physics as those of Indeterminacy, Quantum, and Relativity. It is clear, for example, that she reacted sensitively to the discontinuity feature of the Quantum Theory in her portrayal of character. In addition, many references in the novels hint at the new understanding of matter as light and events rather than as solid "matter." Her images create a feeling for the great movement of matter, as well as for the heat and power in the disintegration which accompanies the reshuffling of elements. They suggest the scientific maxims that total matter or energy cannot be created nor destroyed, and that matter in its basic form cannot be completely determined. A ramification of Einstein's Theory of Relativity, the subjective nature of time also finds expression in the novels. This view of time, a result of the rejection by modern physics of absolute simultaneity, is most fully presented in Orlando's journey through three hundred years of English history.

By-products of the new psychology, especially Freudianism, have influenced Mrs. Woolf's thought, as they have that of other modern writers. Basically they signify the end of absolute and clear-cut distinctions between good and evil, male and female, normal and abnormal. Mrs. Woolf adumbrates these ideas by the use of wish-fulfilment reveries and Freudian complexes, and by the themes of androgyny and homosexuality. Her belief that the true self, so "varied and wandering," cannot be isolated and fixed lies behind her expression of the flux of social and moral values. Orlando, for example, knows that a person may well have several thousand selves.

Perhaps the most important result of the theory of evolution was to advance the principle of life as constant flux and change. More than most novelists, Virginia Woolf had reason to become steeped in evolutionary thought, for there is a hereditary connection between her family and Darwin's. Not only does Mrs. Woolf herself see the various aspects of evolutionary thought, but her characters often see themselves as figures in the chain of change and the struggle for survival.

What emerges from Mrs. Woolf's fiction as one of her most brilliant achievements is a strikingly modern concept of reality. The distinctive character of her writing owes much to her interest in philosophy, her constant awareness of the mystery of life, and her speculations about the question of personal identity and about the possible existence of a "pattern" of life. Although the influence may not have been from reading him directly, there are obvious parallels between the ideas of Bergson and the ideas and style of Mrs. Woolf. She shares his view that when we face reality we are confronted with "duration itself, not with that which endures," and that reality is "fluidity and change."

There are, finally, rare moments of being in The Waves, Mrs. Dalloway, and To the Lighthouse when the most sensitive characters find all the pieces of the reality puzzle falling into place. These glimpses of reality are the high point in the art of Virginia Woolf.

169 pages. $2.25. Mic 57-1357

THE GENTEEL REBELLION: A STUDY OF AMERICAN JOURNALISTIC IMPRESSIONISM IN TERMS OF ITS AUDIENCE, 1880 TO 1920

(Publication No. 20,549)

Darrell I. Drucker, Jr., Ph.D.
University of Minnesota, 1956

Modern sociologists and social theorists generally agree that during the last quarter of the nineteenth century, a major change occurred in the social and economic status of the American middle class. With the rise of large industrial corporations and the consolidation and bureaucratization of business enterprise, the middle class, which had formerly been a class of independent entrepreneurs, became a class of salaried employees, cogs in the machinery of the new bureaucracy.

This change in economic and social status had certain predictable psychological effects on the individual members of the new middle class. David Riesman, C. Wright Mills, and others have shown that such people sought the status, self-respect and independence which they had formerly derived from their economic situation, in other areas of activity. They became receptive to a special philosophy of egotistic individualism and they endeavored to regain lost prestige by adopting a pose of sophistication, cosmopolitanism and cultural snobbery.

The new middle class seems to have found aid and comfort for its new attitudes in the work of the journalistic impressionists – James Gibbons Huneker, Vance Thompson, Percival Pollard and Benjamin DeCasseres, and in a few magazines – Town Topics, M'lle. New York, The Criterion and The Smart Set, which seem to have been designed especially for the new middle class audience. These men and these periodicals offered the new middle class a means of escape from the routine dullness of its new subordinate social and economic situation, a compensation for the anonymity which was the result of the new impersonality of the business and social world, and an opportunity for vicarious and cautious rebellion against old middle class social and moral conventions and against the new restrictions which were the result of its new position in society.

New middle class individualism and rebellion were carefully calculated so as not to endanger the social standing or means of livelihood of the members of that class. The new middle class rebellion was truly a "Genteel Rebellion."

This study shows how the journalistic impressionists, because of certain characteristic attitudes which they shared toward the arts and toward society, were particularly well-qualified to act as spokesmen for, and to, the new middle class. Furthermore, the evidence indicates that a large part of the success and popularity of the impressionist journalists during the forty years that bracketed the turn of the century was due to the rise of the new middle class, which formed their primary audience.

605 pages. $7.70. Mic 57-1358

THE FUNCTION OF IMAGERY IN THE LYRIC: POPE TO WORDSWORTH

(Publication No. 18,986)

Roger Daniels Forseth, Ph.D.
Northwestern University, 1956

The present study proceeds in two steps: the analysis of the function of imagery in the characteristic lyrics of ten major poets – Pope, Thomson, Johnson, Collins, Gray, Smart, Cowper, Blake, Coleridge, Wordsworth – and the comparison of the imagery in these lyric structures to demonstrate certain changes in eighteenth-century poetic practice. The primary purpose is that through the inducing of the poetics of these writers directly from their practice, the student may observe the precise changes in poetic technique which gradually occurred from the Augustan to the Romantic period in English literature. Critical theory, the history of ideas, and questions of source and influence are considered only insofar as they help in the explication of the particular poems.

The first significant conclusion derived from the systematic, chronological analysis of about sixty poems is that in the better eighteenth-century lyrics "poetic diction," far from being mere ornament or dead metaphor, is for the most part highly functional. The generalization that the stylized figurative language of Pope, Thomson, Johnson, and Gray, for example, consists of little more than embellishment must, it is argued, be dismissed altogether. Indeed, their more significant lyric structures have that tightness and complexity of organization of imagery often detected in the better poems of any era. In short, the problem is to determine, not whether Augustan imagery has any serious function at all, but how this function relates to, and can be discriminated from, that to be found in the subsequent important lyrics of the eighteenth and early nineteenth centuries.

Secondly, it is concluded that the dominant process in the imagery of the eighteenth-century lyric is from personification to natural symbol; and that it is clearly a coherent dialectical process of one mode complexly transformed into another. If the personified abstractions of Johnson are compared with the animate, natural symbols of Wordsworth, for example, or the personified seasons of Thomson and Collins with the wind-harp image of Coleridge, only contrasts are perceived. Yet these poets were all treating the Nature they thought significant, and they did so, in their various but not unrelated ways, by breathing life into the ideas of moral nature or – at the other extreme – into the objects of the natural world itself. Indeed, the more the literary relations between personification and symbol are scrutinized, the more convincing it becomes that the revolution in imagery which is said to have occurred in the eighteenth century was, after all, one of measured subversion.

Finally, Blake is judged the crucial pivotal figure in this process. He utilized all the forms of personification practiced earlier in the century and, in essence, he employed the forms of symbolism which became dominant after him. Blake, of course, at no point practiced the sensuous concreteness of Coleridge, though significantly both poets evolved from an early use of formal personification – of the type found most strikingly in the descriptive and allegoric odes of Collins – to an awareness of the intimate interaction between mind and nature. Yet,

different in their characteristic practice as they were, Blake and Coleridge are in a sense brought together in Wordsworth where fidelity to the natural object seldom is developed to extended sensuousness, but only to the point where the emotional impact of the object is impressed upon the mind of the individual. The lyrics of Blake are the supreme examples of the form in the eighteenth century, and not the less so because he was heavily dependent on the techniques of his predecessors.

315 pages. $4.05. Mic 57-1359

THE DIONYSIAN ELEMENT IN THE WORKS OF THOMAS MANN

(Publication No. 17,570)

James B. Hepworth, Ph.D.
University of Utah, 1956

Chairman: Paul E. Wyler

To the ancients as well as to the moderns, the god Dionysos has always been an illusive and changeful figure. He has been known by many names and has appeared in many shapes and guises. To the ancients he was known as the bestower of "divine madness." He was called the mad god, the wine god, the god of the dead, of procreation, fertility and eternal recurrence of all things in nature. His religion was one which was characterized by polarities, extremes, and contradictions. It offered the highest states of intoxication and ecstasy as well as corresponding moments of peaceful bliss, lethargy and delectable inertia. Barbarity and tenderness, insight and madness, pleasure and pain, etc. are enigmatically combined in it. Orgiastic rites which featured wild dancing, sexual excesses, the eating of raw flesh and the drinking of the warm blood of animals were common to this primitive worship. The votaries of the god worked themselves up to a wild state of excitation in which they believed themselves to be possessed by the god and as one with him. While in this state of intoxication the worshippers became conscious of a strange new vitality which permitted them to perform superhuman feats of strength. The instinctive side of their personalities was given free rein so that they were able to liberate themselves from the bondage imposed upon them by reason and social custom.

Though the mythical aspects of the Dionysian can be rationally explained away, the fundamental ideas which characterized the religion of the mad god are of timeless and universal significance. In modern times, and especially in Germany, the Dionysian manifests itself as a philosophy of life which glorifies the instincts and the primitive nature of man.

Friedrich Nietzsche, a formidable votary of the god, erected an entire philosophic system upon the foundations laid by the ancient Thracian deity. He extols the ecstasy and intoxication which characterized the worship of Dionysos. Furthermore he sees in the Dionysian spirit the impelling force, which in conjunction with the formative principle of Apollo, operates behind the creation of all great works of art. J. J. Bachofen associates Dionysos with the feminine principle in life as opposed to the masculine principle championed by Apollo. The feminine symbolizes the chaotic and irrational elements in nature; the masculine those of light, of order and of intellect. Goethe and Stefan Zweig apply the term "demonic" to those elements which, in modern times, correspond to the characteristic irrationality and madness inherent in the primitive religion of Dionysos.

Thomas Mann incorporates the essential elements of both the ancients and the moderns in his own concept of the Dionysian. He agrees in substance with J. H. W. Rosteutscher who sees Germany as the cradle of the reborn Dionysos in modern times. Mann attempts to explain this assumption on the grounds that there is something about the general atmosphere of his native land which is not only favorable to the existence of the Dionysian spirit but which actually awakens it and stimulates its growth. The German nature – which he designates as Deutschtum – is strongly Dionysiac. He suggests that a mysterious union exists between the German mentality and the demonic. He points, for example, to the Germans' Faustian passion to overstep the bounds of god-given knowledge, to their unconquerable urge to plunge into the abysses of the unknown and the unknowable, to their disposition against rationalism and classicism, to their love of the chthonic, irrational and demonic arch-qualities of romanticism, to their susceptibility to genius-giving disease, to the seductive qualities of their own romantic music, art, and beauty. The German nature, he says, leans towards "the forces of the unconscious" and towards "the pre-cosmic life-impregnated darkness." It has "a tendency towards the abyss, towards formlessness and chaos." As typical representatives of Deutschtum Mann singles out among others, Luther, Faust, Goethe, Nietzsche, Wagner, Freud, and Hitler.

The Dionysian element in Mann's works is not limited to its modern aspects. In several of his novels and stories the ancient myth plays an important rôle. In Death in Venice it appears in an unmistakable reiteration of the Dionysian rites which are described in Euripides' The Bacchae. In the Joseph novels Dionysos emerges in the guise of his Egyptian counterpart, that of Osiris. Here the emphasis is placed upon the Dionysian ideas of procreation, fertility, and eternal recurrence. Occasional descriptions of Dionysiac rites are also to be found in Mann's tetralogy. In The Magic Mountain the rôle of Dionysos is taken over by Mynheer Peeperkorn, who becomes the leader and central figure in the frequent Dionysiac revels at the Berghof. He is the reincarnation of the phallic god of sensual nature, the bestower of enthusiasm and of drunken ecstasy. A Biblical parallel of Dionysos emerges in the form of a bull (the golden calf) in Das Gesetz. The sexual aspect of Dionysiac worship is best illustrated in this short work.

Thomas Mann's concept of the Dionysian revolves around two major ideas – that of milieu and that of the inherent nature of man. Consequently, the present study emphasizes these factors in discussing the modern aspects of the Dionysian in his works.

While it is impossible to establish fixed limits to the realm of Dionysos, either in regard to locale or time, the common denominator which prevails wherever the god makes his presence felt is that of madness. The external factors which contribute to this madness constitute the Dionysian milieu. In Mann's works disease and the atmosphere of death appear to be the most important of these factors. However, the sea and the mountains as symbols of the infinite and of nothingness also play an important

rôle since they awaken feelings of longing for the unorganized, death and rebirth. The Slavic element, which symbolizes for Thomas Mann the seat of chaos and disorder, is important in his concept of the Dionysian milieu. Finally, music, art, beauty, and sex round out the main constituents of the general atmosphere in which the mad god feels at home.

Mann is keenly aware not only of the influences of the external Dionysiac forces which work upon the individual from without, but also of those inner, subconscious or superconscious elements exerting their powers from within. Though some of his characters are definitely un-Dionysian or even anti-Dionysian most of his more important personages reveal strong Dionysiac tendencies which lead them into the realms of the dangerous and the forbidden. Naphta, Schleppfuss, Cipolla, Krokowski, etc. belong to a major group of Mann's characters who predicate, by logical means, the destruction and annihilation of the established order of things in order to replace it with barbarism and disorder. They are dispensers of logical confusion, delvers into the depths and abysses of the universal and of the irrational soul. Another group which is represented by such personages as Mynheer Peeperkorn, Madame Chauchat, Kumpf, Esau and Joseph's brothers, are natural uninhibited votaries of Dionysos. They disperse unrest and disorder by emotional rather than by logical means. They are passionate, impetuous personalities, full of romantic excesses and are generally lacking in disciplinary self control. Most of Mann's main characters belong to what might be called the "outcasts," i.e. madmen, criminals and artists. They are dual natures in whom the masculine and feminine principles, spirit and nature, etc. are at constant odds. They are the bearers of what Mann calls the "double blessing," i.e. from the heavens above and the depths below.

The Dionysian experiences which Mann's characters undergo are essentially the same as those which were characteristic in the case of the primitive votaries of the mad god; for, while Dionysos himself appears in various guises, the manifestations of his powers remain always the same. In Death in Venice these experiences are briefly: a longing for the infinite – for death and rebirth, for the unformed and for nothingness; the frenzy and ecstasy which accompanies the anticipation of destruction; the surging up of illicit and uncontrollable passions; the uninhibited acceptance of the forces of disorder and the abyss; the rejection of reason and sanity; the extravagant outbreak of emotional intoxication; the reckless abandonment of modesty and shame; the willing surrender to the sinful and the forbidden; the complete collapse of the inward dykes of self-restraint. In The Magic Mountain similar experiences are apparent. We note, for example, the heightening and the intoxication which accompanies disease; the welling up of subconscious desires; the Faustian urge to explore the secrets of life and of the universe; the acceptance of disease and the abandonment of reason; the desire for death and rebirth; the urge to become lost in the vastness of space, to plunge into the unknown; the erotic passion which is the result of disease; the succumbing to feelings of self-forgetfulness; states of lethargy and boredom; the delving into the realms of the occult. Again in the Joseph novels the "divine madness" manifests itself in various ways, e.g. as a longing for freedom and release, for "becoming" and returning again to the primitive; as the ecstasy of ritualistic reunion with the All, the abandonment and intoxication of moon-worship, the urge to enter into the realms of the questionable and the forbidden, the passionate participation in the rites of Dionysos, the breaking through of suppressed passions, the desire for union with the god, and as the bliss which accompanies the casting off of modesty and shame. In Doctor Faustus the Devil assumes the rôle of Dionysos, and his powers are reflected in the experiences of his victims who run the gamut of Dionysiac emotions. For example there are: the thirst for knowledge, the superhuman and supernatural gifts; the urge to expose the unexposed, to go beyond the normal bounds of scientific research; the desire to break through and cast off all limitations; the yearning for intoxication, for illumination, for genius-giving disease; the towering flights of fancy; the upliftings and unfetterings, feelings of power and triumph, of melancholy and elation; the longing to return to the primitive and the barbaric; the impulse to break down the barriers of time and space; the breaking out of passion and crime. In Fiorenza the inward fire, the frenzy, the demon, the madness which both Lorenzo and the Prior know in different forms, reveals itself as the intoxication of the wine, the lusts of the flesh, and the lust for power. In Tristan the principal characters experience transports of joy and pain, rapture and despair, a yearning for eternity and the absolute and a mystical union with one another and with the All.

Mann's personal attitude towards Dionysos changes during the course of his career as a writer. In his early period he appears as an exponent of romanticism and music (both of which, in his opinion, belong to the realm of Dionysos). In his later life he treats them with caution and reserve. In his early Betrachtungen eines Unpolitischen he expresses a concern that the ascendancy of reason is a threat to art in that it would eventually produce a general standardization of the mind. This attitude gradually gives way to the growing conviction that the element of reason is of prime importance in achieving the humanistic synthesis of intellect and feeling, of spirit and nature, of the Apollonian and the Dionysian. However, Mann never entirely rejects the Dionysian. Even in Doctor Faustus, the work which marks his most damning accusation against the forces of the demonic, he concedes that the influence of the powers of the underworld are quite necessary in every sphere of human endeavor.

223 pages. $2.90. Mic 57-1360

GLENWAY WESCOTT: A CRITICAL AND BIOGRAPHICAL STUDY

(Publication No. 20,631)

Sy Myron Kahn, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Frederick J. Hoffman

This dissertation assesses the contribution of Glenway Wescott (b. 1901), Wisconsin novelist, poet, essayist, critic and short story writer, to twentieth century American literature. The study considers all that has been written by and about him, establishes the values of his work and places it in relation to American literature of the past seventy-five years.

Since most of Wescott's fiction and poetry was written during the 1920s, the thesis focuses upon those years and his place in an experimentally rich, literary decade. Wescott reacted against routine farm life and a drab region of enervated pioneer spirit and vanished "poetry." So powerful and indelible were these experiences that Wescott expended his literary energy of the twenties in recreating and analyzing the Wisconsin that had nurtured him, wounded him, and caused him ultimately to reject it. Though emphasizing critical evaluation, the study accents the crucial relationships between his life and work, and with the advantage of biographical material direct from Wescott himself, explores how raw and haphazard experiences are shaped for literary purposes. Holograph and variant texts permit a study of esthetic methods and development within a particular work and from one work to another.

Chapter I traces Wescott's growth, beginning with his earliest unpublished poetry, and marks his development into imagist poet (The Bitterns, 1920 and Natives of Rock, 1925). While briefly attending the University of Chicago (1917-18) at the height of the "Chicago renaissance," Wescott was influenced by the imagists. Chapter II concentrates on the literary and personal sources of his poetry and describes how that discipline helped prepare him for greater accomplishments in prose. Chapters III and IV evaluate the work of a youthful regional novelist and short story writer of increasing sophistication (The Apple of the Eye, 1924; The Grandmothers, 1927; Good-Bye Wisconsin, 1928), and point out the local and foreign influences on his art. Chapter V explains Wescott's increased world consciousness (Fear and Trembling, 1932) and his loss of talent during the thirties, while Chapter VI analyzes his later fiction (The Pilgrim Hawk, 1940 and Apartment in Athens, 1945), the fruit of his repatriation and reflourishing of talent. Chapter VII recapitulates forty years of literary performance and attempts to fix the prevailing patterns and values of his work.

Many literary experiments and techniques of his time converge in Wescott's poetry and fiction and establish him as one of America's literary pioneers. For more than a decade (1921-23) he lived in France to gain perspective on America and through his work extend her literary and intellectual horizons. With Wisconsin as metaphor, Wescott's fiction provides insight into our Middle West, its various levels of reality and its special tensions, and explains the impulses motivating intellectual pioneering and the dilemmas of the expatriate. In Wescott's recreation of both the past of a locale and a personal past, the dimensions of his work extend beyond regional boundaries and individual experiences and suggest a fable of America. With the publication of The Babe's Bed (1930), Wescott exhausted the Middle West material; his later work deals with international characters, settings, themes and problems.

As stylist as well as regional writer, Wescott makes an important literary contribution. Trained in the disciplines of imagist poetry, he employs a precise diction and lyrical style to evoke the past; the style is a highly perfected instrument for communicating states of mind and nostalgic recollection. No less a scrupulous artist in his later work, he shifts from subjective rendering and impressionism to a more objective, analytical method and demonstrates an increased mastery of narrative strategy. His work unfailingly testifies to his ideals of literary excellence. The dissertation makes clear that any thorough assessment of American literature must inevitably take Wescott's work into account. Although the constellation of his work is less luminous than those of our major American writers, it will continue to shine with its own particular brilliance.

561 pages. $7.15. Mic 57-1361

OBJECTIVE CRITERIA OF SYNTAX AND THE DETERMINATION OF AUTHORSHIP IN SPANISH LITERATURE: A STUDY OF THE METHOD AND ITS VALIDITY

(Publication No. 20,390)

John Watson Martin, Ph.D.
University of Washington, 1956

The study of Ruth Davis on the authorship of the first act of the Celestina;[1] that of Leavitt Olds Wright on the -ra verb form in Spain,[2] in which are treated the authorship problems of the Celestina, La estrella de Sevilla, and La tía fingida; and that of M. Criado de Val on La tía fingida,[3] are reviewed in terms of the criteria used and of linguistic considerations involved in those criteria. Through a diachronic study of the forms in -ra and -se, around which the aforementioned studies are centered, the functions of these forms at the level of evolution corresponding to each of the problems of authorship are established and the methodology of the proposed solutions is invalidated. The differences in the verbal system of prose as opposed to verse-drama of the Golden Age are established, and a contribution is made to historical syntax in the study of the mechanism of the shifts of the verbal system involving the forms in -se and -ra.

147 pages. $2.00. Mic 57-1362

1. "New Data on the Authorship of Act I of the Comedia de calisto y Melibea," University of Iowa Studies in Spanish Language and Literature, III, 1928.

2. "The -ra Verb Form in Spain," University of California Publications in Modern Philology, XV, No. 1, 1932.

3. "Análisis Verbal del Estilo. Indices verbales de Cervantes, de Avellaneda y del autor de La tia fingida," Revista de Filología Española, anejo LVII, Madrid, 1953.

JOHN MILTON'S PAMPHLETS ON DIVORCE

(Publication No. 20,392)

Lester Deane Moody, Ph.D.
University of Washington, 1956

In making an annotated edition of such a work as Milton's five divorce tracts, the problem confronting one at all times is that of search, and added to this is the difficulty created by the casualness of Milton's reference to names. Usually he used the last name of an individual without further identification as to the time the man lived, his accomplishments or his contribution to learning. For example, he may state that something happened by order of Philip. The difficulty here obviously is in finding which

Philip he had in mind. It so happens that there were more than 25 kings named Philip from 700 B.C. to 1609 A.D. This type of reference was fairly common and caused great difficulty in discovering exactly to which man he referred. The work was further complicated by Milton's habit of using Latinized names because it was not uncommon that the Latinized name did not appear in any available texts but had to be identified through translating the original into Latin. On other occasions Milton was true to his Puritan principles in that he did not prefix "Saint" to the names of the canonized and in many cases he would use the simple surname.

Biblical references could usually be found without much trouble, but it was not uncommon to discover Milton had made his own translation. In such instances, if the passage could not be found in any Bible available, a comparable passage in the King James version was looked for, and then it was assumed that Milton had made his own translation. On occasion Milton begins a sentence or phrase from one verse and completes it with something from a different verse. In some cases at least, this seemingly was done.

The greatest difficulty, however, stemmed from Milton's habit of making casual references to obscure names or historical events that were but incidentally or remotely related to his subject. This very likely was his way of confusing enemies. He boldly states in Tetrachordon:

> It is a general precept, not only of Christ, but of all other Sages, not to instruct the unworthy and the conceited who love tradition more than truth, but to perplex and stumble them purposely with contriv'd obscurities.

This habit of perplexing and using contrived obscurities not only troubled his attackers, but added enormously to the problem of editing. Such often required days of searching to discover whether more than a brief note was necessary.

The importance of this edition has at least five definite points. First, it adds to the clarity and understanding of Milton. Few people can read the five divorce tracts and understand all his references and his reasons for making them; therefore, this adds a certain general understanding of the man and his method of attacking a problem. Second, the fact that he dealt with the problem of divorce as he did brings into focus many of the issues important to his time, of which the reader might otherwise be unaware. Third, it contributes concrete evidence of the astonishingly wide range of Milton's knowledge and reading. Fourth, it reveals the operation of Milton's mind in bringing the experience of the past to bear revealingly upon the problems with which he and his age were seriously concerned. Fifth, the work emphasizes again an outstanding characteristic of Milton, that he saw knowledge as important, not for the sake of knowing, but for the sake of using, an idea expressed in Of Education:

> . . . language is but the instrument conveying to us things useful to know. And though a linguist should pride himself to have all the tongues that Babel cleft the world into yet, if he have not studied the solid things in them as well as the words and lexicons, he were nothing so much to be esteemed a learned man as any yeoman or tradesman competently wise in his mother dialect only.

524 pages. $6.65. Mic 57-1363

OCTAVE PIRMEZ ET LA VIE INTELLECTUELLE BELGE (OCTAVE PIRMEZ AND THE INTELLECTUAL LIFE IN BELGIUM)

(Publication No. 17,563)

Andrée Marie-Louise Paheau-Barnett, Ph.D.
University of Utah, 1956

Chairman: Donald K. Barton

A layman who would attempt to form an opinion about the philosophy of life of the Belgian people through Belgian literary works would undoubtedly be impressed with the lack of intellectuality in that country. This is largely due to the fact that since Belgium declared itself independent in 1830 trends in literature have been guided by the desire to describe and celebrate the Belgian countryside. Yet there have been a few writers who have been concerned with the problems of mankind as well as with the matters of their native land. One of those is Octave Pirmez, a thinker whose work treats subjects of universal interest, independent of temporal and spatial limitations.

Born in the 19th century, Pirmez for many years remained obscure if not completely unknown to the rest of the literary world. During the last quarter of a century, however, critics and authors alike have begun to manifest a keen interest in his works. Since at present there is no comprehensive study of the works of Octave Pirmez, of his place in Belgian literary life nor of his humanistic philosophy and artistic contribution to the field of letters, this thesis proposes 1) to establish the place of Octave Pirmez as a representative of Belgian letters of French expression; 2) to determine the value of his contribution to the intellectual life in Belgium as a precursor and as an author; 3) to study the intellectual, esthetic and philosophical principles which directed him in his constant search for a higher degree of human perfection.

The plan of research followed includes: the literary and artistic situation in Belgium during the nineteenth century; the relationship between Pirmez and his contemporaries based upon an investigation of his relations with family, friends and associates; the influence of Pirmez upon the succeeding generation of artists and literateurs and a chronological study of the critical appraisal of him as a writer; the source and development of his ideas and feelings from the formative period to maturity; and finally the three facets of his personality: the thinker, the artist, the mystic, which served as a tripod in his ascension toward truth.

The literature of Belgium has its beginning in 1830 with the declaration of Belgium as an independent nation. During the 19th century, Belgium occupied a key position in Europe and indulged in the materialistic trend of mind that characterizes the era of the industrial revolution. In spite of an admittedly rich artistic patrimony and a literature wrongly included with that of neighboring countries and classed as secondary material, the 19th century Belgium deliberately devoted herself to a search for more comfort and to the enjoyment of purely materialistic satisfactions. Although at that time the various conditions were anything but propitious to the Renaissance of the literature within the country, a few talented persons tried to stimulate the sensitivities and to give a new impulse to the remaining intellectual elements. Three men especially have contributed greatly to the Renaissance of Belgian

letters: a poet, Van Hasselt; a novelist, De Coster; a humanist, Pirmez.

In this milieu of industrialization completely devoid of any motivative intellectual attitude, lacking any true artistic disposition and guided by a sense of ethical value warped by an excessive importance placed upon the material side of life, Pirmez expresses his apprehension of the future. He fears a decline of morality and has a desire to help his fellowmen to pursue loftier principles of living. His work is filled with a feeling of dispair resulting from the inanity of his efforts.

Pirmez was a Belgian at heart. Although he traveled extensively, for him the greatest pleasure of the journey was when he returned to his homeland. Pirmez's works bear the mark of his Belgian origin. In particular, this author represents very well the nature and temperament of southern Belgium. Pirmez is a true Walloon having a courageous and romantic soul which gives precedence to feelings over reason. Deep but clear in his thoughts, he was gifted with musical talent and united in a happy harmony love of work and propensities to meditation.

Pirmez occupies a dual position in Belgian literary life – that of a forerunner and that of an author. As a forerunner, Pirmez influenced the JEUNE BELGIQUE, a movement of literary revival, which introduced in Belgium the philosophy of art for art's sake and whose leaders claimed Pirmez as one of their principle ancestors. As an author, Pirmez's intrinsic value resides in his work, the content of which deals mainly with problems of human interest. Each page offers to the reader rich material for thought, each section studies problems which challenge everyone who wonders and questions, each book describes experiences which are familiar enough to be readily understood. His work presents suggestions sufficiently new to command attention and sentiments lofty enough to win admiration.

A careful study of the formation of Pirmez's ideas shows that his environment, his education and his era orientated his innate propensities toward romantic feelings and humanistic thoughts. He was guided by a father gifted with a meditative soul, a pious, virtuous, well-informed mother, and friendly and learned professors. The parks surrounding the chateaux in which he lived and the nearby pastoral valley of the Sambre river nourished his love for nature. He traveled to Italy and to Germany with the desire of finding a countryside that would be in harmony with his soul. As a result, most of the emotional qualities found in Pirmez are those which characterize the romantic soul. His favorite authors, chosen according to his own preferences and moods, were those who had thirsted for a greater human nobility. A detailed analysis of his work reveals that he also devoted himself to a constant search for a higher form of human perfection.

As a thinker, this search for self betterment taught him the necessity of becoming familiar with the thoughts of the great masters who before him had possessed the same ideal of creating in themselves a higher type of human being. This pursuit led him to study human differences so as to understand their relativity without exaggerated optimism but rather with a critical perspicacity and induced him to compare his experiences with those of the past in order to verify the soundness of his own thoughts. This quest forced him to establish a rule for living according to his personal capabilities and to adopt a mode of thought and action which would be the result of his own choice. The contact with the great students of civilization helped him to appreciate the grandeur of man, his genius, the power of his artistic creations, the progress of his thoughts and of his moral life, the latent possibilities of both the individual and of society; it proved to him that the constant progression of the individual toward greater wisdom is a unique personal experience the value of which is measured by the effort made to attain this wisdom.

As an artist Pirmez selected beauty for his guide, beauty in all of its manifestations. He would have liked to abandon himself completely to the cult of beauty and form. The moralistic side of his nature, however, checked this esthetic tendency and compelled him to yearn for a compromise between the philosophy of art for art's sake and that of utilitarian art. The oscillation between these two conceptions of the purpose of art is responsible for the claim made by the representatives of both these movements that Pirmez shared with them the basic principle of their respective philosophy and thereby widened the scope of his prestige among writers.

Avoiding dogmatism, Pirmez never wrote an Ars Poetica because he did not place too much emphasis on technique as such but was primarily interested in the reasons for producing works of art. His work, however, contains sufficient commentaries, criticisms and counsels on the arts in general, on painting and literature more especially, that one may readily reconstruct his artistic ideal. Pirmez does not offer any novelty to the reader; he merely indicates his own interpretation of the rules of esthetics which when applied have produced masterpieces. For Pirmez to love, to observe, to suffer and to conceive are the four successive actions which lead to the creation of a masterpiece. Avoiding all classifications, he considers the true artist to be the one who having applied the accepted standardized rules of esthetics, with enthusiasm, sincerity and spontaneity creates a work of art which is in harmony with the thoughts and feelings of any man of common sense.

Guided by this ideal of beauty, subjected to the ideal of the good, Pirmez stands out as an esthetic idealist in the most minute details of his private life. In spite of his desire to be useful to society, aware of his inability to make himself heard and understood by those who preferred not to hear him, he isolated himself from all experiences except those of absolute beauty. This artistic and etherial conception has contributed to make of him that misunderstood "solitaire," self-incarcerated in the most elevated spheres to which only those privileged ones, prompted by artistic impulses and an always new enthusiasm, have access.

The third aspect of Pirmez's personality, a mystic of nature, is a meditation guided by reason seeking a rule of conduct. Wounded in his ideals by a man-made world which had been cruel to him, weaned of love by a great disappointment, Pirmez retired into nature which he contemplated and loved. Nature offered him all the goodness which civilization refused him. In the boundless profundity of her silence, he saw the greatest possibility of contact with the divine and sought to unite himself intimately with nature so as to be closer to God.

Pirmez was never able to enjoy the complete fusion of ecstacy experienced by the true mystic because of the ambivalence of his own nature. He lacked humility, was not inflamed by the ardour of penitence, could not detach himself entirely from the comforts of life, nor resist the

pleasure and satisfaction of meditative analysis. To remedy these deficiencies, Pirmez endeavored to express in a work of art his thirst for perfect beauty, his desire to see heaven on earth and his constant aspiration toward the absolute and the eternal.

Octave Pirmez whose work transcends the boundaries of his country occupies in Belgian literature of French expression a place which is much more important than he anticipated. His influence was greater than he ever supposed it could be. He merely wrote to satisfy the craving for immortality deeply imbedded in his soul and not for the betterment of the reader. He knew that the lofty subject matter of his work would appeal only to a small group of elite souls belonging, as he did, to the humanistic tradition to which they strove to conform and by which they are united. Octave Pirmez did not know, however, that the struggle which took place in his heart would be the starting point of the revival of the Belgian letters and would call forth interest and admiration from all sides.

262 pages. $3.40. Mic 57-1364

DAS LÖWENLEITMOTIV IN RICARDA HUCHS LEBENSWERK

(Publication No. 19,218)

Kristina Eugenia Trendota, Ph.D.
University of Minnesota, 1956

An analysis of Ricarda Huch's animal symbols, the significance of which has not yet been investigated, is still in its initial stages. The present thesis is concerned mainly with her leading symbol, the lion, though at the same time it throws revealing light on her other major symbols. As such it offers a unique key to her poetic as well as critical, historical, philosophical and religious writings as a whole. This ancient and universal symbol represents her basic belief in a living tradition of literary form and thought. She condenses her own personal message in the symbolic form of this proverbial king of the beasts.

In her writings the lion especially indicates the heart, as the seat of the unconscious, as contrasted polarically with the self-conscious brain. In view of modern intellectualist tendencies Ricarda Huch feels it necessary to restore the balance by stressing the former function. This characteristic approach is for example expressed in her preference for the magnanimous lion instead of the more restricted lamb; likewise the sun and the sea, both perilous and, at the same time, beneficial, are interchangeable symbols with the lion representing her concept of life and God.

Ricarda Huch advocates the harmony of the "lion nature" as her ultimate ideal – i.e. strong instincts and productive energy – along with the reflective tendencies of the first Romantic School in Germany. (Chapter I.) In keeping with her desire to combine both classical and romantic elements she chooses the lion-metaphor because it contains in its classical appearance the dionysian element. (Chapter II.) Due to its many-sidedness the lion approaches the human level in the author's animal-hierarchy which otherwise consists merely of "noble" or "ignoble" animal-types. More individual is her strong preference for felines while the dog, for example, always represents a slavish lack of personality. Still another aspect of her lion is that of caricature and humor. Here her animal-metaphors carry on the tradition rooted in the satiric literature of the Reformation perion. (Chapter III.) The lion, again is contrasted with the writer's concept of evil as personified in Lucifer whose domain is the brain, instead of heart, and whose symbols are the technical (i.e. perpetuum mobile), financial (i.e. Golden Calf), totalitarian (Leviathan) activities of the modern state. (Chapter IV.) The dionysian and Christian lion is also the symbol of resurrection. In this sense the Wandering Jew supplies a symbolic contrast in rejecting transformation and death. The myth of the lion-man, Hercules, in his role of "Holy Hero," is accordingly one of her favorite motifs. (Chapter V.) Together with the eagle the lion indicates her heroic and revolutionary inclination to restore a more vital tradition. (Chapter VI.) In the final chapter a comparative study is made both of the lion as character-symbol as well as of lion-communities, such as the Holy Roman Empire. (Chapter VII).

304 pages. $3.90. Mic 57-1365

DEMOCRACY AND CULTURE: THE IDEAS AND WORK OF CHARLES ELIOT NORTON

(Publication No. 19,219)

Rolfe Kermit Vanderbilt, Ph.D.
University of Minnesota, 1956

Charles Eliot Norton (1827-1908) is an important figure in American intellectual and literary history. His life as a businessman, humanitarian, journalist, teacher, scholar, and public man was dominated by one concern. He tried to discover (as did Tocqueville, Whitman, Arnold, and other writers of the nineteenth century) whether a healthy "culture" can develop in an egalitarian society. During his life, Norton struggled to resolve the contraries between his Puritan ancestry and his own age. One implied celebration of mind and worship of values and traditions of the past; the other embodied enterprise and reform, the new egalitarian spirit, and a vigorous civilization springing up in the West.

Critics have presented Norton as an alienated figure in America, either yearning for the age of Dante, or anticipating the disillusioned 1920's. Either view has a certain attractiveness, and one can find evidence to support both interpretations. But actually Norton was very much a part of his own time. He shared some of its most extravagant hopes as well as its gloomier forebodings. A striking pattern of disenchantment characterizes his life. His impulsive enthusiasms – Chartism, European revolutions, popular education, model lodging-houses, Leaves of Grass, the public-lecture platform, the Dime Novel, the mass-circulation newspaper, Civil War patriotism, the teachings and spirit of Emerson, the writing of Howells and Fuller, the Chicago Exposition – such signs of the "progress of democracy" he first welcomed and later questioned. That he stayed in America (though drawn to Europe) and continued to serve the country and criticize its foibles suggests an ultimate faith in popular intelligence. So, too, does his "democratic" interpretation of the cathedrals of the Middle Ages. During the 1890's, when American public life tested that faith most severely, he continued to

praise the New World with its "larger, more generous, modern spirit of democratic society, in which each man has the opportunity and is consequently under the responsibility to make the best of himself for the service of his fellowmen." In 1893, he eagerly attended the Chicago World's Fair, and in 1896, he still believed that any man might become a leader "by virtue of the right use of faculties which are a common inheritance, and of qualities which every youth . . . may hope to attain." Despite Norton's friendship with many of the leading men of letters in America and England, the portraits of two Americans – John Brown and Abraham Lincoln – shared the mantelpiece in his summer home at Ashfield, Massachusetts.

The affirmative spirit of Emerson lived on in Norton, though in his maturity he made a searching reappraisal of the values Emerson had handed on to a "less childlike" generation of Americans. Hence Norton becomes an important transitional figure between an earlier America and the less optimistic twentieth century. He anticipated the humanism of Irving Babbitt, Paul Elmer More, and T. S. Eliot, all of whom acknowledged their debt to Norton. In Norton's thought and work, therefore, we discover important links between the age of Emerson and the age of Eliot. 310 pages. $4.00. Mic 57-1366

RICHARDSON AND FIELDING: A STUDY IN THE EIGHTEENTH-CENTURY COMPROMISE

(Publication No. 19,479)

Allan Edward Wendt, Ph.D.
Indiana University, 1956

This study compares the novels of Richardson and Fielding, relating them to the ethical beliefs of the first half of the eighteenth century. In the early work of those two novelists may be seen an imaginative expression of the extremes of eighteenth-century ethical opinion; in their development as novelists may be charted the changing ethical views of their time.

The eighteenth-century ethical background is represented in terms of a political metaphor: right-wing orthodoxy is defined by the rigoristic side of Bernard Mandeville's work; left-wing liberalism is defined by the writings of the third Earl of Shaftesbury; the middle of the road is defined chiefly by the three great Restoration preachers whose work was most popular in the eighteenth-century – Tillotson, South, and Barrow. Although Mandeville may have adopted his views for reasons not in themselves highly moral, he offers the clearest statement of a still prevailing point of view – the belief in man's depravity and consequently man's need of Grace, his need to deny his nature in order to achieve virtue. Shaftesbury is the clearest and most influential spokesman for the opposite view; he expresses plainly a belief in man's benevolence, in man's ability to achieve his own salvation by fulfilling rather than by denying his nature. Both these points of view could draw strength from the works of Tillotson, South, and Barrow; the Restoration preachers retained their popularity in the eighteenth century, and many other men achieved popularity, because they presented a comfortable middle-of-the-road position.

The central portion of the study examines the six major novels of Richardson and Fielding in terms of the moral extremes outlined above. Richardson represents the orthodox position, but his development marks a qualified acceptance of the more liberal views usually associated with his rival. Pamela presents a relatively unsophisticated statement of the moral compromise: preaching an orthodox moral view that is as rigorous as Mandeville's, the heroine comes finally to practicing a utilitarianism that is also like Mandeville's; without intending it, and without, of course, calling Pamela's activities "vices," Richardson came close to dramatizing Mandeville's central paradox. Clarissa marks Richardson's awareness of his danger, and is consequently his most orthodox novel; by making the heroine choose death rather than marriage, he denies the compromise dramatized by Pamela. Sir Charles Grandison represents a conscious withdrawal from the implications of extreme orthodoxy; Richardson emphasizes the hero's natural benevolence and thus attempts to adopt the liberal moral views of his time.

Fielding's first major novel, Joseph Andrews, in part as a conscious reaction to the repressive orthodoxy and unsatisfying compromise of Pamela, presents an aesthetically satisfying vision of man's potential goodness, of the benevolence which is a part of man's nature; it represents Fielding's clearest support of the liberal point of view. With Tom Jones, Fielding enters the arena of moral compromise: adding the concept of "prudence," he tries to support his vision of goodness with casuistical argument; he tries to show that virtue can be practicable as well as aesthetically satisfying. In his last novel, Amelia, Fielding adds certain orthodox concepts to his earlier liberal views, especially in the person of Dr. Harrison and in the means by which Captain Booth is "converted." Thus Amelia defines, for Fielding, the limitations of the liberal point of view.

In these ways, Richardson and Fielding, starting their careers on opposite sides of the eighteenth-century moral road, gradually moved closer to the center. Studied together, their novels present an accurate picture of the moral milieu from which they grew, and help to define the shape of moral belief to come.

492 pages. $6.25. Mic 57-1367

ANALYTICAL SOLUTIONS FOR THE OPTIMIZATION OF ROCKET TRAJECTORIES

(Publication No. 18,715)

Louis Carl Barrett, Ph.D.
University of Utah, 1956

Chairman: Clarence R. Wylie, Jr.

A number of papers have been written in recent years which pertain to the problem of analyzing the optimum burning program of a rocket-powered aircraft. When the flight is horizontal, this optimum problem may be formulated as follows:

"Let it be required to determine the mass-velocity relationship which maximizes the range of a rocket when it pursues a straight level flight and fulfills a prescribed set of initial and final velocity conditions on a specified quantity of propellant."

Another optimum problem relating to modes of escape from, or entry into, satellite orbits by a rocket has also appeared in the literature.

It is the purpose of this thesis to present several optimum problems which, aside from the author's own publication in a classified document, have apparently received no adequate treatment to date.

Only one of these will be cited here for this will suffice to enable the reader to readily discern wherein our general problem differs from that set off in quotes above.

"Let a rocket, with an arbitrary initial velocity, be required to expend its fuel continuously during the course of a given flight time. Moreover, suppose that at the instant the flight time terminates the rocket is to have a prescribed final velocity. Of all paths the rocket may pursue in fulfilling these conditions we desire the one(s) over which a minimum of fuel is required."

We define a path thus characterized as an optimum trajectory corresponding to the prescribed velocity conditions.

We commence our discourse with a derivation of the general differential equation of rocket motion when drag is neglected and the rocket is ideally regarded as a particle of variable mass. This equation is then particularized in the case of a constant, as well as that of an inverse square force field. Chapter 1 ends with a brief discussion of multi-nozzled rockets.

Chapter 2 is primarily concerned with optimum rocket motion in a constant gravity field. It begins with an elementary problem of the calculus of variations which we capitalize upon to deduce necessary and sufficient conditions that a trajectory, corresponding to a prescribed set of initial and final velocity conditions, shall be an optimum.

Thereafter, we obtain necessary and sufficient conditions for optimum motion when a prescribed change of altitude, as well as the initial and final velocity components, is prescribed. The following remarkable conclusions are especially noteworthy.

"If during a fixed flight time a rocket is to describe an optimum trajectory corresponding to specified initial and final velocity conditions and a prescribed change of altitude, then the direction of the thrust must necessarily remain invariant throughout the motion, and this, independent of the conceivable modes of continuous burning which may precipitate the motion."

"Let a rocket traverse any one of the optimum trajectories corresponding to a prescribed set of initial and final velocity conditions, its initial position being identical in each case. Then, at the instant burn-out occurs, the rocket will be located on the straight line segment connecting the 'terminal' points of the optimum trajectories which correspond to all of the optimum fuel supply being utilized instantaneously at the beginning or end of the flight time. Furthermore, the constant direction of the thrust on the rocket is independent of the mode of fuel expenditure and is the same as that defined by an arrow drawn from the second to the first of the afore-named points."

After establishing these criteria, we apply them to ascertain the spacial distribution of all possible positions a rocket may occupy when it terminates an optimum mode of motion. The chapter ends with a concise account of one-parameter modes of burning.

In Chapter 3 we exhibit three different methods for obtaining necessary conditions for optimum rocket motion in a general central force field. One of these methods is also shown to be applicable in the case of constant gravity.

A law of variation for the angle of thrust during optimum rocket motion in a general, and in an inverse square force field is also derived.

104 pages. $2.00. Mic 57-1368

NON-LINEAR EQUATIONS IN A BANACH SPACE

(Publication No. 20,505)

Leon Brown, Ph.D.
University of Minnesota, 1956

This dissertation generalizes the Weierstrass Preparation Theorem (see Bochner and Martin, Several Complex Variables) and the Erhardt Schmidt Branching Theory (see Lichtenstein, Vorlesungen uber einige Klassen nichtlinear Integralgleichungen und Integro-differential gleichugen).

Consider a function f with domain in X x C and range in C, where X is a complex Banach space and C is the space of complex numbers, which is analytic and bounded for $||x|| \leq 1, |w| \leq 1$. Assuming that f(0, w) has an s-fold zero at w = 0, then

$$f(x, w) = \left(w^S - \sum_{V=1}^{S-1} H_V(x)\, w^V \right) \Omega(x, w) = P\Omega$$

where $H_V(x)$ is an analytic function on X to C and Ω is a non-zero analytic function on X x C to C in a neighborhood of the origin, (0, 0). The size of this neighborhood is estimated and P and Q are represented as integrals of the

function f. If one considers the functions f as elements of a suitable Banach space, then P and Ω are analytically dependent on f.

In proving this theorem, the author arrives at a generalization of the Euclidian Algorithm. Given two functions f and g with domain X x C and range in C analytic for $||x|| \leq 1$, $|w| \leq 1$, and for every x_0 such that $||x_0|| \leq 1$, $f(x_0, w)$ has s zeros in $|w| < 1$, then there exists uniquely a polynomial P in w of degree $< s$ with coefficients analytic functions on X to C, and a Q(x, w) analytic in the unit sphere such that $g = Qf + P$ and Q and P can be represented as integrals involving f and g.

We consider the functional equation $x - f(x) = y$ where $f(0) = 0$, and x, and y are in a complex Banach space X. In addition, we assume that f is analytic and bounded for $||x|| \leq 1$, and $f'(0)$, a linear function on X to X is a compact transformation. The situation where $(I - f'(0))^{-1}$ exists is well known. We assume that the inverse of $I - f'(0)$ does not exist. In this case, we find that there exists:

1) a finite dimensional subspace M C X,
2) a subspace $\mathcal{K}$ C X,
3) $g_i(x, y)$, i = 1, ..., k, analytic in a neighborhood of the origin of X x x with range contained in C, and
4) $G(x, y, \mathcal{S})$ analytic in a neighborhood of the origin of X x X x M with range contained in $\mathcal{K}$.

These are related to our problem in the following ways:

1) $x \in X$, then $(I - f'(0))x = 0$ if and only if $x \in M$, and
2) $x \in X$, then $x - f(x) = y$ if and only if
   a) $x = x_1 + \mathcal{S}$ where $x_1 \in \mathcal{K}$ and $\mathcal{S} \in M$,
   b) $g_i(x, y) = 0$, i = 1, ..., k, and
   c) $x_1 = G(x_1, y, \mathcal{S})$.

Applying a fixed point theorem, we find that there exists a function $x(y, \mathcal{S})$ with domain a neighborhood of X x M and range in $\mathcal{K}$, such that $x_1 = G(x_1, y, \mathcal{S})$, if and only if $x_1 = x(y, \mathcal{S})$. We find that $x(y, \mathcal{S})$ is analytic in this neighborhood. Placing $f_i(y, \mathcal{S}) = g_i(x(y, \mathcal{S}) + \mathcal{S}, y)$, we see that $x(y, \mathcal{S}) + \mathcal{S}$ is a solution of the functional equation, $x - f(x) = y$, if and only if $f_i(y, \mathcal{S}) = 0$, i = 1, ..., k. We also note that the set of solutions is contained in a finite dimensional analytic manifold of X. The sizes of all above mentioned neighborhoods are estimated in this paper.

We assume that $f_i(0, \mathcal{S}) \neq 0$, for all i. We apply the generalization of the Weierstrass Preparation Theorem to these functions, and then the classical elimination theory in order to arrive at our "branching equations." Taking another approach, we have the following theorem: let R be the ring of functions, with domain and range in X, which are analytic at the origin, then R is integrally closed. It is then easily seen that a monic polynomial in the polynomial ring of R can be factored uniquely into irreducible monic polynomials. 85 pages. $2.00. Mic 57-1369

FUNCTIONAL COMPETENCE IN MATHEMATICS OF LOUISIANA HIGH SCHOOL SENIORS

(Publication No. 19,735)

Robert Carl Brown, Ph.D.
George Peabody College for Teachers, 1956

Major Professor: J. Houston Banks

The Problem

The purpose of the study was an attempt to determine, (1) the degree of functional competence in mathematics attained by high school seniors in Louisiana, (2) the types of errors students make in applying their mathematics, (3) the significant differences in competence in mathematics according to the training of the pupils, and (4) to make recommendations for improvements based upon the findings of the study, the literature in the field, and the experiences of the writer.

Procedure

Functional Competence is defined by the twenty-nine items of the Check List found in the Guidance Pamphlet prepared by the Commission on Post-War Plans. A group is considered functionally competent on an item if 67 per cent of them get the correct answer. The Davis Test of Functional Competence in Mathematics was administered to the seniors of twenty-eight selected public high schools in Louisiana.

Indices of achievement were computed for each of the eighty items of the test according to the course patterns of the students. The total Louisiana proficiency index was 34.3 per cent.

The traditional programs for two, three, and four years are still the best for attaining functional competence. The more years of mathematics a student has had, the higher is his functional competence. Two, three, and four year programs have proficiency indices of 27.2, 38.5, and 48.4. The best program available, the Algebra I, Algebra II, Plane Geometry, $\frac{1}{2}$ Solid Geometry, and $\frac{1}{2}$ Trigonometry had an index of only 54.8.

Basic weaknesses in Functional Competence were as follows: (1) nature of the decimal system, both place value and base, (2) estimating amounts and answers, (3) nature of approximate numbers and measurement, (4) statistics, (5) reading tables, interpolation, interpretation, (6) how and when to use the Pythagorean Theorem, (7) conversion of units, (8) formulas and problems involving formulas, (9) exponents, (10) trigonometry—tangent and sine relationships, and (11) consumer problems.

An analysis of the errors in computation indicated the following weaknesses: (1) carelessness and lack of understanding, (2) poor understanding of per cents and percentage problems, (3) confusion of terms, time in hours and minutes, or in years and months, (4) lack of knowledge of vocabulary, such as mills, kilowatts, centimeters, etc., (5) weakness in computation, borrowing, carrying, place value, etc., (6) poor understanding of the correct order when more than one of the fundamental operations must be used, such as expanding by the distributive law, (7) inability to express mixed numbers as improper fractions, (8) confusion between factors and terms of an expression, and (9) lack of knowledge of elementary geometric definitions.

The recommendations for improvement based upon the findings of the study, the literature in the field, and the observations of the writer are summarized below.

1. The state board should establish a special state mathematics coordinator or supervisor—an appointive position with money and authority to carry out a program.
2. Set up a program for self-evaluation.
3. Revise requirements for high school graduation.
4. Establish inservice training at the state level for mathematics teachers.
5. Pay higher salaries to mathematics and science teachers.
   a. To attract more and better teachers.
   b. To meet industry's salaries.
6. Set up a program of mathematics in Functional Competence.
7. Do not abandon General Mathematics for the slow learner.
8. Revise and strengthen the existing program.
9. Remove business arithmetic and senior mathematics courses from the curriculum.
10. Cooperate with the colleges and universities to prepare the teachers for the new program.
    a. Require courses in the teaching of arithmetic.
    b. Require courses in the teaching of general mathematics and Functional Competence.
    c. Obtain trained college personnel interested in mathematics teaching programs.

196 pages. $2.55. Mic 57-1370

THE ASYMPTOTIC BEHAVIOR OF CERTAIN TRIGONOMETRIC SUMS

(Publication No. 20,445)

Cecil Eugene Duncan, Ph.D.
Stanford University, 1957

Asymptotic developments are found for sums of the following type:

$$\sum_{n} n^{T} f^{(t)}\left(\frac{\pi n}{p} + \pi\gamma\right) .$$

Under these assumptions:

1. The summation variable n runs through the values A+1, A+2, ..., B, where B-A is a non-negative integer, and A and B are real numbers;
2. p is a large positive number;
3. T and t are non-negative integers;
4. $f^{(t)}(x) = \frac{d^t}{dx^t}(\csc x)$ or $\frac{d^t}{dx^t}(\cot x)$;
5. γ is an arbitrary real number;
6. A, B, and γ can be written in the form

$$A = \lambda p + \mu,\ B = \nu p + \rho,\ \text{and}\ \gamma = \sigma + \frac{\tau}{p} ;$$

where $\lambda, \mu, \nu, \rho, \sigma, \tau$ are bounded functions of p.

The developments are obtained first by writing the sums as infinite integrals, then expanding these integrals into asymptotic series in terms of $\frac{1}{p}$. Sharp inequalities for the remainder terms are given.

The study of these series has led to an interesting generalization of the Euler-McLauren summation formula, namely,

$$\sum_{n=A+1}^{B} f(n) = \int_{A-\alpha}^{B-\beta} f(x)dx + \sum_{s=0}^{h} \frac{\varphi_{s+1}(\beta+1)}{(s+1)!} f^{(s)}(B-\beta) - \sum_{s=0}^{h} \frac{\varphi_{s+1}(\alpha+1)}{(s+1)!} f^{(s)}(A-\alpha) - R_{h+1}$$

where

$$R_{h+1} = \int_{A-\alpha}^{A+\theta} \frac{\varphi_{h+1}(A+1-x)}{(h+1)!} f^{(h+1)}(x)dx + \int_{A+\theta}^{B+\theta} \frac{\varphi^{*}_{h+1}(B+1-x)}{(h+1)!} f^{(h+1)}(x)dx + \int_{B+\theta}^{B-\beta} \frac{\varphi_{h+1}(B+1-x)}{(h+1)!} f^{(h+1)}(x)dx .$$

In this formula α and β are arbitrary real numbers; $0 < \theta < 1$; $\varphi_n(x)$ is the n^{th} Bernouilli polynomial; $\varphi^{*}_n(x)$ is the function with period 1 which coincides with $\varphi_n(x)$ in $0 \leq x \leq 1$; and the other parameters are defined above.

For functions of the type $g(\frac{n}{p} + \gamma)$ the formula is particularly useful:

$$\sum_{n} g\left(\frac{n}{p} + \gamma\right) = p \int_{\lambda+\gamma}^{\nu+\gamma} g(y)dy + \sum_{s=0}^{h} \frac{\varphi_{s+1}(\mu+1)}{(s+1)!\, p^{s}} g^{(s)}(\nu+\gamma) - \sum_{s=0}^{h} \frac{\varphi_{s+1}(\rho+1)}{(s+1)!\, p^{s}} g^{(s)}(\lambda+\gamma) - R_{h+1}$$

where

$$|R_{h+1}| \leq \frac{C_h(\mu, \rho)}{p^{h+1}} K\{|\mu+\theta| + |B-A| + |\rho+\theta|\} ,$$

K satisfies the inequality $g^{(h+1)}(y) \leq \frac{K}{p^{h+1}}$, and $C_h(\mu, \rho)$ depends only on h, μ and ρ.

198 pages. $2.60. Mic 57-1371

AN ECONOMIC APPROACH TO THE CHOICE OF CONTINUOUS SAMPLING PLANS

(Publication No. 20,448)

Geoffrey Gregory, Ph.D.
Stanford University, 1957

If a machine is producing a continuous sequence of items, its output may be inspected by a sampling plan. One result of the sampling is to improve the outgoing quality by means of the elimination of defective items, and a second purpose for which the plan might be designed is the detection of any deterioration in the quality of the output. When it is suspected that deterioration has taken place, the plan should specify appropriate corrective action,

which, for example might involve the shutting down of the machine. It is shown how an objective rule for taking corrective action can be included in a continuous sampling plan, and how to choose a plan. The criterion used in the selection of a plan is the maximization of the average income per unit time. Several district types of plan are discussed with the object of finding the optimal plan within each type.

In order to analyse the effect of a plan on a production process, a model for the process must be assumed. The process begins in the good state, but before each item is produced there is a constant probability that it goes into the inferior state. Once the process is in the inferior state, it cannot return to the good state unless corrective action is taken at the machine.

Two methods of deriving the average income are demonstrated. Maximization of the income over the parameters of the plan presents difficulties, but if the plan is of a certain regular type, then the principal sampling rate is of a given order in the transition probability, which is assumed small. The average income function, an approximation to the principal sampling rate and the approximate optimal income is given for several plans.

An indication of how this entire procedure can be extended to the case where the production consists of a continuous flow is presented. Further miscellaneous topics are considered such as a minimax approach to the choice of the plan, the comparison of systematic, stratified and random sampling, and a numerical example for one particular plan. 92 pages. $2.00. Mic 57-1372

SOME GENERALIZATIONS OF FULL NORMALITY

(Publication No. 19,423)

Maynard Joseph Mansfield, Ph.D.
Purdue University, 1956

Major Professor: Melvin Henriksen

Three classes of generalizations of fully normal spaces are studied in this thesis. The first is the class of countably paracompact normal spaces. The fact that countably paracompact normal spaces are obtained as a generalization of fully normal spaces by inserting the word "countable" in the appropriate places in the definition of full normality seems to be new, and is obtained as a corollary to a theorem which gives several necessary and sufficient conditions that a normal space be countably paracompact. These conditions are, for the most part, analogous to the well-known necessary and sufficient conditions, established by A. H. Stone, E. Michael, J. L. Kelley and J. S. Griffen, that a regular (Hausdorff) space be paracompact [cf. e. g. J. L. Kelley, General Topology, New York: D. Van Nostrand, 1955, Theorem 5.28 and Exercise 5.U]. Particularly worthy of mention is the following: A normal space X is countably paracompact if and only if for each countable locally finite collection $\{A_i : i = 1, 2, \ldots\}$ of subsets of X there is a countable locally finite collection $\{G_i : i = 1, 2, \ldots\}$ of open subsets of X such that $A_i \subset G_i$, $i = 1, 2, \ldots$.

The above-mentioned equivalences are applied to the proofs of the following theorems: (i) Every F_σ-subset of a countably paracompact normal space is countably paracompact and normal. (ii) The union of a locally finite collection of closed, normal, countably paracompact subspaces is countably paracompact and normal. (Theorem (ii) is not new [cf. E. Michael, Continuous selections I, Ann. of Math. (2) vol. 63 (1956) pp. 361-382, Theorem 8.2 ff.].)

The two other classes of generalizations studied are defined as follows. A collection $\mathcal{B}$ of subsets of a set X is said to be an $\mathfrak{m}$-star refinement ($\mathfrak{m}$ any cardinal number ≥ 2) of a collection $\mathcal{A}$ if (i) $\mathcal{B}$ is a refinement of $\mathcal{A}$ and (ii) if $\mathcal{C} \subset \mathcal{B}$, $2 \leq |\mathcal{C}| \leq \mathfrak{m}$, and $\cap \{C : C \in \mathcal{C}\} \neq \phi$, then there is an $A \in \mathcal{A}$ such that $\cup \{C : C \in \mathcal{C}\} \subset A$. $\mathcal{B}$ is an almost-$\mathfrak{m}$-star refinement of $\mathcal{A}$ if (i) $\mathcal{B}$ is a refinement of $\mathcal{A}$ and (ii) if $M \subset St(x, \mathcal{B})$ (= $\cup \{B \in \mathcal{B} : x \in B\}$) for some $x \in X$ and $2 < |M| < \mathfrak{m}$, then there is an $A \in \mathcal{A}$ such that $M \subset A$. A topological space X is said to be $\mathfrak{m}$-fully normal (resp. almost-$\mathfrak{m}$-fully normal) if each open covering of X admits an open $\mathfrak{m}$-star (resp. almost-$\mathfrak{m}$-star) refinement. Each fully normal space is $\mathfrak{m}$-fully normal for every $\mathfrak{m} \geq 2$, and each $\mathfrak{m}$-fully normal space is almost-$\mathfrak{m}$-fully normal. An almost-2-fully normal space is collectionwise normal [cf. H. J. Cohen, Sur un problème de M. Dieudonné, C. R. Acad. Sci. Paris vol. 234 (1952) pp. 290-292]. An example, due to R. H. Bing, is given of a collectionwise normal space which is not almost-2-fully normal. The class of almost-2-fully normal spaces is shown to coincide with the class of all spaces X for which the family of all neighborhoods of the diagonal in $X \times X$ is a uniformity for X. (This result is not new [cf. Cohen, op. cit.].)

It is shown that every linearly ordered space is $\aleph_0$-fully normal and that, for any ordinal α, the linearly ordered space $W(\omega_{\alpha+1})$ is $\aleph_\alpha$-fully normal but not almost-$\aleph_{\alpha+1}$-fully normal. It is an open question as to whether an almost-$\mathfrak{m}$-fully normal space is $\mathfrak{m}$-fully normal, even for $\mathfrak{m}$ finite. It is known that if a space X is k-fully normal for some finite k, then X is n-fully normal for every finite $n = 2, 3, \ldots$. It is not known if the analogous statement for almost-k-fully normal spaces is true or not. An example is given of a 2-fully normal space which is not almost-$\aleph_0$-fully normal; this space, however, is not a Hausdorff space. It is an open question as to whether every 2-fully normal Hausdorff space is almost-$\aleph_0$-fully normal.

It is shown that each closed subspace of an $\mathfrak{m}$-fully normal (resp. almost-$\mathfrak{m}$-fully normal) space is itself $\mathfrak{m}$-fully normal (resp. almost-$\mathfrak{m}$-fully normal). Moreover, if each open subspace of an $\mathfrak{m}$-fully normal (resp. almost-$\mathfrak{m}$-fully normal) space is $\mathfrak{m}$-fully normal (resp. almost-$\mathfrak{m}$-fully normal), then every subspace is $\mathfrak{m}$-fully normal (resp. almost-$\mathfrak{m}$-fully normal). Finally, the questions of topological completeness and separation of arbitrary subsets by means of open sets are investigated for $\mathfrak{m}$- and almost-$\mathfrak{m}$-fully normal spaces. In particular, it is shown that every almost-$\aleph_0$-fully normal space is countably paracompact. 80 pages. $2.00. Mic 57-1373

ASYMPTOTIC DISTRIBUTION OF STOCHASTIC APPROXIMATION PROCEDURES

(Publication No. 19,787)

Jerome Sacks, Ph.D.
Cornell University, 1956

Let M be a regression function i.e., for each real x $M(x) = E\,Y(x)$ for some family of random variables $\{Y(x)\}$. Let $\{a_n\}$ be a sequence of positive real numbers such that $\Sigma\, a_n = \infty$, $\Sigma\, a_n^2 < \infty$. Then, if X_1 is an arbitary real number, the Robbins-Monro procedure for stochastically solving the equation $M(x) = \alpha$ is given by the sequence $\{X_n\}$ determined recursively by

$$X_{n+1} = X_n - a_n[Y(X_n)-\alpha] \tag{1}$$

Let f be a regression function $(f(x))=EY^*(x)$ for some family $\{Y^*(x)\}$ and let $\{a_n\}$ and $\{c_n\}$ be sequences of positive real numbers such that

$$c_n \to 0,\ \Sigma\, a_n = \infty,\ \Sigma\, a_n^2 c_n^{-2} < \infty .$$

Then, if X_1^* is an arbitrary real number, the Kiefer-Wolfowitz procedure for finding the point at which f has a maximum is given by the sequence $\{X_n^*\}$ determined recursively by

$$X_{n+1}^* = X_n^* - a_n c_n^{-1}[Y^*(X_n^*-c_n) - Y^*(X_n^*+c_n)] \ . \tag{2}$$

The problems considered are concerned with the asymptotic distribution of the sequences $\{X_n\}$ and $\{X_n^*\}$.

These problems were first treated by Chung (Ann. Math. Stat., Vol. 25 (1954), pp. 463-483) whose methods have been the basis for all work done heretofore on this matter. By using different methods we are able to improve the results of Chung and others about the asymptotic normality of the suitably normalized sequences $\{X_n\}$ and $\{X_n^*\}$. The method used here is to iterate (1) and (2) and group the result into three terms two of which are shown to go to 0 while, by making use of a central limit theorem for dependent random variables, the third term is shown to be asymptotically normal.

Without listing all the conditions required for their validity some of the results obtained are as follows. For the Robbins-Monro procedure, if $M(x) = \alpha + \beta(x-\theta) + o(|x-\theta|)$ near θ and $a_n = An^{-1}$ for suitable A, then $n^{1/2}(X_n-\theta)$ is asymptotically normal (Theorems 1 and 1′). For the Kiefer-Wolfowitz procedure let $f(x) = \alpha + \beta(x-\theta)^2 + \delta(x,\theta)$. In Theorem 3 it is proved that if $\delta(x,\theta) = o(|x-\theta|^2)$ then, taking $a_n = An^{-1}$ and $c_n = n^{-1/4}$, $n^{1/4}(X_n^*-\theta)$ is asymptotically normal. If $\delta(x,\theta)$, considered as a function of x, is symmetric in a neighborhood of θ then, for a_n An^{-1} and for many sequences $\{c_n\}$, $n^{1/2}c_n(X_n^*-\theta)$ is asymptotically normal (Theorems 2 and 2′). There are enough sequences $\{c_n\}$ so that for any sequence $\{d_n\}$ going to 0 there is a sequence $\{c_n\}$ going to 0 more slowly. If $\delta(x,\theta) = 0(|x-\theta|^3)$ then Theorem 4 shows that for $a_n = An^{-1}$ and $\{c_n\}$ as in Theorem 2 $n^{1/3}c_n(X_n^*-\theta)$ is asymptotically normal. By examples it is shown that in the results of Theorems 2 and 4 c_n cannot be replaced by a constant for all n; in fact, this is so for any choice of $\{a_n\}$. All the results mentioned are extended to certain multi-dimensional analogues of these two procedures. 67 pages. $2.00. Mic 57-1374

"n" DIMENSIONAL CONSIDERATIONS OF BASIC PRINCIPLES A AND B OF THE UNIFIED THEORY OF RELATIVITY

(Publication No. 19,482)

Robert C. Wrede, Ph.D.
Indiana University, 1956

The unified theory of relativity, as set forth by Einstein, revolves around three principles indicated by V. Hlavatý. This paper deals with the first two of these principles which are as follows:

Principle A The algebraic structure is imposed on the space by a general real tensor $g_{\lambda\mu}$.

Principle B The differential geometric structure imposed on the space by the tensor $g_{\lambda\mu}$ is determined by a connection $\Gamma_{\lambda\mu}^{\ \nu}$ defined as follows.

$$\partial_\nu g_{\lambda\mu} = \Gamma_{\lambda\nu}^{\ \ \alpha} g_{\alpha\mu} + \Gamma_{\nu\mu}^{\ \ \alpha} g_{\lambda\alpha} \tag{1.1}$$

In "The Elementary Basic Principles of the Unified Theory of Relativity, B"[1] Hlavatý determined a general solution for the system of equations (1.1) but the solution is not explicitly in terms of $g_{\lambda\mu}$. The solution $\Gamma_{\lambda\mu}^{\nu}$ of the equations (1.1) is expressed explicitly in terms of $g_{\lambda\mu}$ in "The Elementary Basic Principles of the Unified Theory of Relativity, B_2"[2] for the case n = 4. The main purpose of this paper is to determine, subject to certain restrictions, the solutions of the system of equations (1.1) in terms of $g_{\lambda\mu}$ for all values of n.

The core of this paper may be indicated as follows. The general real tensor $g_{\lambda\mu}$ is assumed to be known. The symmetric part of $g_{\lambda\mu}$ is indicated by $h_{\lambda\mu}$ while its skew symmetric part is indicated by $k_{\lambda\mu}$. The tensor $h_{\lambda\mu}$ plays the part of the metric tensor of the space. In particular, we raise and lower indices by means of $h_{\lambda\mu}$ and the associated contravariant form $h^{\lambda\mu}$.

As a first step in solving the system (1.1) we are able to express $\Gamma_{\lambda\mu}^{\nu}$ in the form

$$\Gamma_{\lambda\mu}^{\ \ \nu} = \left\{ {\nu \atop \lambda\mu} \right\} + S_{\lambda\mu}^{\ \ \ \nu} + U^{\nu}_{\ \lambda\mu} \tag{1.2a}$$

where $\left\{ {\nu \atop \lambda\mu} \right\}$ is the usual Christoffel symbol expressed in terms of the symmetric tensor $h_{\lambda\mu}$, and

$$S_{\lambda\mu}^{\ \ \ \nu} \overset{\text{def.}}{=} \Gamma_{[\lambda\mu]}^{\nu}\ U^{\nu}_{\ \lambda\mu} \overset{\text{def.}}{=} 2h^{\nu\alpha}\, S_{\alpha(\lambda}^{\ \ \ \beta}\, k_{\mu)\beta} \ .^{3} \tag{1.2b}$$

Examination of the relations (1.2)a,b shows that our problem is effectively transferred to that of determining the quantities $S_{\lambda\mu}^{\ \ \ \nu}$. It is found that the components $S_{\lambda\mu}^{\ \ \ \nu}$ are solutions of the set of equations

$$2\, S_{\lambda\mu\nu}\ X^{\lambda\mu\nu}_{\alpha\beta\gamma} = K_{\alpha\beta\gamma} \tag{1.3a}$$

where

$$X^{\lambda\mu\nu}_{\alpha\beta\gamma} \overset{\text{def.}}{=} \delta^{[\lambda\mu]\nu}_{[\alpha\beta]\gamma} - 2\ \delta^{[\lambda}_{\gamma}\, k_{[\alpha}^{\ \ \mu]}\, k_{\beta]}^{\ \ \nu} - 2\ \delta^{\lambda}_{[\beta}\, k_{\alpha]}^{\ \ \mu}\, k_{\gamma}^{\ \ \nu} \ .^{4} \tag{1.3b}$$

$$K_{\alpha\beta\gamma} \overset{\text{def.}}{=} -\bar{\nabla}_\alpha k_{\beta\gamma} - \bar{\nabla}_\beta k_{\gamma\alpha} + \bar{\nabla}_\gamma k_{\alpha\beta} \tag{1.3c}$$

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We make the agreements that

(1.4) (a) $\mathrm{Det}(g_{\lambda\mu}) \neq 0$

(b) The signature of $h_{\lambda\mu}$ is $- - - - - - - +$

In order to conveniently solve the system of equations (1.3)a, a non holonomic frame of reference is introduced in an intrinsic manner, (that is by means of our given information). In particular the vectors which form the non holonomic frame of reference are given rise to by the roots of the characteristic equation

$$(1.5)a \quad \lambda^{w}(\lambda^{2m} + K_{2-w}\,\lambda^{2m-2} + \ldots + K_{2m-w}) = 0$$

$$w = \begin{cases} 0 \text{ if } n = 2m \\ 1 \text{ if } n = 2m+1 \end{cases}$$

no sum on w

where

$$K_{2p-w} \overset{\text{def.}}{=} k_{\gamma_1 \ldots \gamma_{2p}}[\gamma_1 \ldots \gamma_{2p}]$$

Our problem is divided into three categories which are characterized by means of the coefficients of the characteristic equation as follows:

(1.6)
1) $K_{2m-w} \neq 0 \qquad j = 1 \ldots m-1$
2) $K_{2j-w} \neq 0$
$K_{2j+2-w} = K_{2j+4-w} = \ldots K_{2m-w} = 0$
3) $K_{2-w} = K_{4-w} = \ldots = K_{2m-w} = 0$

Furthermore the generality of the problem is restricted by the agreements that

(1.7) a) The non zero roots of the equation (1.7)a are distinct.

(1.7) b) In situation (1.8)2 (i.e. when 2j of the roots of (1.7)a are $\neq 0$ while the remaining are equal to zero) the rank of $k_{\alpha\beta}$ is 2j.

Since we prove in situation (1.8)2 that the rank of $(k_{\alpha\beta})$ is either 2j or 2j + 2, the restriction (1.7)a is not as great as it first appears.

The solution of the system of equations (1.3)a will involve quantities

$$(1.8) \qquad \lambda_{xyz} \overset{\text{def.}}{=} 1 + \lambda_x\lambda_y + \lambda_y\lambda_z + \lambda_z\lambda_x$$

These quantities will appear in the denominator of the solution, hence we need to determine necessary and sufficient conditions that they be different from zero.

It is seen that the presence of the quantities λ_{xyz} in our solution does not impair putting it in tensor form. Finally, the tensor solution obtained with respect to a non holonomic frame of reference is written in terms of general coordinates. The paper attacks the problem just outlined by

a) Making the necessary algebraic considerations.

b) Discussing the geometry revolving around the tensors $h_{\alpha\beta}$ and $k_{\alpha\beta}$.

c) Bringing about the solution of the system (1.3)a.

83 pages. $2.00. Mic 57-1375

1. "The Elementary Basic Principles of the Unified Theory of Relativity, B", Journal of Rational Mechanics and Analysis, Jan. 1953, Vol. 2, No. 1.

2. "The Elementary Basic Principles of the Unified Theory of Relativity B_2", Journal of Rational Mechanics and Analysis, March, 1955, Vol. 4, No. 2.

3. $A_{[\lambda\mu]} \overset{\text{def.}}{=} \frac{1}{2}(A_{\lambda\mu} - A_{\mu\lambda})$, $A_{\lambda\mu} \overset{\text{def.}}{=} \frac{1}{2}(A_{\lambda\mu} + A_{\mu\lambda})$

4. $\delta^{\lambda\mu\nu}_{\alpha\beta\gamma} \overset{\text{def.}}{=} \delta^{\lambda}_{\alpha}\,\delta^{\mu}_{\beta}\,\delta^{\nu}_{\gamma}$

MUSIC

CERTAIN ASPECTS OF THE SONATA-ALLEGRO FORM IN PIANO SONATAS OF THE 18TH AND 19TH CENTURIES

(Publication No. 19,454)

William W. Abbott, Jr., Ph.D.
Indiana University, 1956

The study was concerned with reporting on complete analyses of 143 piano sonata movements in sonata-allegro form by Haydn, Mozart, Beethoven, Schubert, and Brahms. Six other movements, also in sonata-allegro form, by Schumann, Chopin, and Liszt were analyzed completely but reported only summarily. The factors analyzed were as follows:

1) Formal structures of expositions and recapitulation;
2) Ratios of duration of expositions, developments and recapitulations;
3) Ratios of duration of formal groups within expositions and recapitulations;
4) Percentage of measures of established tonality as opposed to tonally indeterminate measures;
5) Initial keys of sections of the form;
6) Key progressions in terms of the interval of connection between tonics of succeeding keys;
7) The use of exchange of mode on the same tonic (parallelism);
8) Mode change between keys with different keys with different tonics; and
9) Key relation and the ratio of duration of tonalities.

Findings pointed out certain inadequacies in present-day descriptions of the sonata-allegro form, and noted chronological regular tendencies toward expanding key relationships.

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Three of the more important findings are as follows:

1) The sonata-allegro form consists of three principle sections, exposition, development and recapitulation. While each principle division occupies roughly one-third of the movement, there is, in 53 per cent of the movements analyzed, less development than exposition and less exposition than recapitulation. This is true particularly if a coda follows the recapitulation and, for purposes of computation, is included as a part of the recapitulation. Furthermore, although in some other movements the exposition may be larger than the recapitulation, in 81 per cent of all movements, the development is the smallest of the three principle sections.

2) The so-called fifth relationship is less characteristic of Haydn and Beethoven than of Mozart. The perfect fifth is the interval of key connection in 41 per cent of modulations of Haydn, 51 per cent of those of Mozart and 43 per cent of those in the works of Beethoven. Combined second and third relationships occupy a higher percentage in the works of all composers except Mozart. Chronologically, from Haydn to Brahms, the progressive frequency of use of invervals lies in the regularly increasing occurrence of the major 3rd, the minor 2nd and various augmented and diminished intervals, while the fifth relationship is equal in frequency only to that of the minor 3rd in the works of Schubert, and is of less frequent use than either the minor 3rd or the major 2nd in the movements of Brahms.

3) A table of key relations was established in which keys were related to the initial tonic of a movement by virtue of the number of tones contained in the tonic of the alternate key which were alterations of the diatonic system of the original key. In the works of the composers there was found a chronologically regular progression toward the use of more distantly related keys. On the other hand, it was found that the more distantly a key was related to the original tonic, the less time was spent in the distant key. Exceptions to this rule were the keys of ♭II, ♭III and ♭VI which, from one point of view, are Neapolitans respectively, of tonic, supertonic and dominant.

357 pages. $4.60. Mic 57-1376

THE RELATIONSHIP BETWEEN THE MANNHEIM SCHOOL AND THE MUSIC OF FRANZ BECK, HENRI BLANCHARD AND PIERRE GAVEAUX (VOLUMES I AND II)

(Publication No. 17,640)

Burton Stimson Carrow, Ph.D.
New York University, 1956

The purpose in this investigation is to trace the relationship between the musical compositions of the Mannheim School, as represented by Johann Wenzel Stamitz and Christian Cannabich, and the musical works of Franz Beck and two of his pupils, Henri Louis Blanchard and Pierre Gaveaux.

The excellence of the Mannheim orchestra under the leadership of Stamitz and Cannabich, and the contributions which these composers made to symphonic tradition, earned an international reputation for the Mannheimers. Beck studied with Stamitz and at an early age left the Palatinate. He eventually settled in Bordeaux, where he established his musical reputation as a composer, organist and teacher. Among his many students were Blanchard and Gaveaux, both of whom achieved recognition in their chosen field.

The investigation of the music of the Mannheim School was limited to the works of Stamitz and Cannabich which are reproduced in the Denkmäler Deutscher Tonkunst, second series. Beck's music was obtained from primary sources in the European libraries where printed and manuscript copies of his works are catalogued. These works were copied over a period of nine months, and in the case of any discrepancy between the manuscripts and printed copies it was assumed that the former were correct. All available works of Blanchard and Gaveaux were investigated, both in printed and manuscript form.

The analysis of these compositions was accomplished as follows: (A) analysis of formal outline, melody and rhythm; (B) analysis of harmonic vocabulary; (C) analysis of instrumentation and variety of voice parts. Each of these specific stylistic features was diagrammed and indexed.

Upon the completion of the analyses, a descriptive summary was written with the purpose of revealing the stylistic features of the works of these composers in regard to each of the analytic steps. The works of Beck were compared with those of the Mannheimers, while those of Blanchard and Gaveaux were compared with those of Beck, to find points of deviation and similarity in style. In addition, those features which are characteristic of the works of all five composers are presented and substantiated with musical examples drawn from the analyzed scores of their works.

The results of the analysis disclose that certain positive relationships are obvious in the works of the Mannheimers and in those of Beck. Melodic and harmonic progressions, cadence formulae, formal design and rhythmic structure in Beck are undoubtedly derived from the Mannheimers. Evidence indicates that Beck is not devoid of originality and that many of the techniques of the Mannheimers become somewhat altered and refined in his style. The influence of Stamitz and Cannabich is not restricted to the symphonic works, but is apparent in the miscellaneous orchestral compositions as well as in the vocal and keyboard works.

A similar comparison of the results obtained from the analysis of the Beck works with those of Blanchard and Gaveaux reveals that these younger French composers failed to assimilate the style of their teacher. Their works are in a lighter vein; aridity of harmonic content, lack of rhythmic vitality and undistinguished melodic lines are their chief characteristics.

The conclusion reached is that Beck continued to write in the Germanic tradition while Blanchard and Gaveaux failed to cultivate the Mannheim musical style in France. Thus, Beck was not successful in transplanting the German musical style on foreign soil.

These conclusions have significance for teachers of harmony, form, music history and instrumentation. The musical works themselves possess value for the music educator on the secondary and college level due to their restricted instrumentation and their slight technical demands.

458 pages. $5.85. Mic 57-1377

BÉLA BARTÓK AND A GUIDE TO THE MIKROKOSMOS (VOLUMES ONE AND TWO)

(Publication No. 17,678)

Benjamin Suchoff, Ed.D.
New York University, 1956

It was the purpose of this investigation to prepare a guide to the teaching of Béla Bartók's Mikrokosmos, a collection of 153 progressive pieces and 33 exercises in six volumes, for the piano.

In addition to a determination of the technical and musical aspects of the Mikrokosmos, Bartók's views concerning the playing and teaching of the piano and his objectives in the composition of the work were ascertained. An historical study of the Mikrokosmos also was made as a result of the availability of Bartók's manuscripts and other unpublished documents on file at the newly-established Béla Bartók Archive in New York City. Other data were secured from former Bartók pupils and colleagues by means of correspondence and interviews. In the guide the pieces are listed by title in numerical order and the pedagogical instruction for each composition is given in outline form under four major headings: Technique, Musicianship, Bartók's Comments, and Suggestions. The guide was submitted for validation to a jury of five prominent pianists and educators.

The principal findings of the investigation are as follows:

1. The Mikrokosmos is an approach to piano playing in the form of a progressive method which represents a synthesis of Béla Bartók's experiences as pianist, piano teacher, musicologist, and composer.

2. Bartók's conception of the piano was in terms of its being an instrument capable of producing sounds ranging from the most to the least percussive in quality, and he specified key-striking, the so-called "percussive touch," as the basic way the piano is to be played.

3. Bartók's philosophy of performance was truth in interpretation: neither add to nor subtract from the composer's intention as expressed in the written score. In accordance with this principle, he was careful to indicate in the Mikrokosmos exactly how he wanted the work played.

4. Bartók's philosophy of performance was extended to his teaching, and he did not permit deviations without justification on the part of the pupil. Further, he stressed musicianship above technique; in fact, he believed that technique was the means rather than the end in piano playing.

5. Bartók's objectives in the composition of the Mikrokosmos were to provide pianists with pieces suitable for concert use and to acquaint them with music written in different styles, to teach beginners of various ages the technique and musicianship of the instrument from the beginning to a certain higher degree, and to acquaint piano students with East European folk music by means of graded transcriptions. Several sources have stated that the Mikrokosmos was intended to serve as a reference book for students of composition, but this was never given recognition as an objective by the composer.

6. Although forty-five per cent of the pieces and exercises in the Mikrokosmos contain examples of interval, chord, and broken chord playing, the work is essentially a method for the development of hand and finger independence and the act of touch. On the other hand, the Mikrokosmos cannot be considered as a method for the development of virtuosity per se (the composer did not intend it as such) since passage-work for the attainment of velocity such as trills, tremolos, double-note and chord passages, scales, and arpeggios are virtually ignored.

7. The tables and figures in the chapter on musical problems in the Mikrokosmos indicate the extent as well as the progressive order of presentation in terms of such fundamentals of musicianship as score reading (problems of rhythm and pitch) and interpretation (problems of tempo, dynamics, tone color, and phrasing). Aspects of style, covering such items as melody, tonality, harmony, and form, are recognized in connection with certain specific pieces.

389 pages. $5.00. Mic 57-1378

PHARMACOLOGY

NEUROPHARMACOLOGICAL STUDY OF RAUWOLFIA ALKALOIDS ON VASOREGULATORY MECHANISMS

(Publication No. 18,703)

Krishna Prasad Bhargava, Ph.D.
University of Utah, 1956

Chairman: Dr. Herbert L. Borison

The purose of this research was to obtain direct evidence for the locus of hypotensive action of Rauwolfia by selective stimulation and ablation at various levels of the neuraxis, and to compare the effects of certain individual Rauwolfia alkaloids on central vasoregulatory mechanisms. The study was performed on 197 cats; in 126 of these experiments the stereotaxic technic was employed. In most cases, the animals were anesthetized with intraperitoneal pentobarbital sodium (35.0 mgm./kgm.). All cats were routinely vagotomized and maintained on artificial positive-pressure ventilation. Blood pressure was usually recorded from the carotid artery by means of a bellows manometer on smoked-paper kymograph. Intravenous injections of drug solutions were made through an indwelling polyethylene catheter in a femoral vein.

The effects of alseroxylon, a purified mixture of Rauwolfia alkaloids, and reserpine, one of the constituent alkaloids of alseroxylon, were studied on vasoregulatory systems. No evidence could be obtained for any local activating effect of Rauwolfia on afferent receptor sites, stimulation of which causes hypotension, since carotid sinus denervation, with or without nodose ganglionectomy, during the peak effect of the drug, did not result in neurogenic hypertension. Rapid intravenous injection of alseroxylon produced an immediate and transient fall in blood

pressure attributable to a peripheral (cardiac or vascular) action, as concluded from experiments on spinal preparations.

Studies on differential effects of Rauwolfia alkaloids on hypothalamic, medullary and spinal vasomotor activity were performed. Supraspinal loci of vasomotor integration were electrically stimulated with bipolar needle electrodes oriented by means of a stereotaxic instrument. Elevation of CSF pressure after cord ligation at C-7, within the meninges, was used to evoke pressor responses from the spinal level. Alseroxylon was found to have a primary depressant action at the spinal level as a pronounced depressant action at the medullary and hypothalamic level. The medullary depression seemed to be more pronounced than the hypothalamic. Reserpine, on the other hand, did not exhibit a significant spinal component of action but exerted a definite depressant effect, though of moderate degree, on supraspinal mechanisms. Alseroxylon produced a marked fall in blood pressure level whereas reserpine produced a slight fall in blood pressure level after a long latency. Hypotension and depression of vasomotor reflex excitability by the Rauwolfia preparations could be demonstrated even following midcollicular decerebration; the hypothalamus was thus excluded. Vasoinhibitory responses to electrical stimulation of the medulla were more readily depressed by the drugs than were pressor responses to either medullary stimulation or carotid occlusion. The physiological implications of these findings are discussed in the light of recently proposed hypotheses concerning the locus of hypotensive action of Rauwolfia.

Next, in order to account for the more pronounced effects of the alseroxylon fraction as compared with the single alkaloid reserpine, a comparative study was made of the effects of certain individual Rauwolfia alkaloids other than reserpine. The Rauwolfia alkaloids (reserpinine, rescinnamine, serpentine, ajmaline and ajmalicine) were investigated for their central vasodepressant effects by the same technics as were employed for reserpine and alseroxylon, on the medullary (electrically-evoked) and the spinal (CSF compression-induced) pressor responses. Epinephrine (or non-epinephrine) was used to evoke peripheral pressor responses to compare with the central effects. 5-Hydroxytryptamine was also included in this study because it has been implicated as a mediator in the action of reserpine and rescinnamine.

The alkaloids rescinnamine and reserpinine were grouped with reserpine on the basis of the mild depression of electrically-evoked medullary pressor responses, and the lack of any important effect on pressor responses from spinal compression and from the injection of epinephrine. The alkaloids serpentine and ajmaline have been grouped with alseroxylon on the basis of a primary depression of the pressor responses induced by spinal compression as well as a potent depressant effect on medullary excitability. These alkaloids also did not antagonize pressor responses to epinephrine. Serpentine was so much like alseroxylon that serpentine may be considered the single alkaloid most representative of the alseroxylon mixture. Ajmaline, on the other hand, produced a rise in blood pressure level instead of a fall. Ajmalicine has been demonstrated by the cross-circulation technic to possess central depressant activity in addition to its peripheral adrenergic blocking property. However, the adrenergic effects of ajmalicine are not demonstrable in the small amounts present in alseroxylon. 5-Hydroxytryptamine (5-HT) has been included in the reserpine group not only because of the few effects which 5-HT shared with reserpine, but also because 5-HT did not produce spinal vasomotor depression. The effects of the various alkaloids on the blood pressure level are complex and have been discussed in the light of central vasodepressor activity. The investigations with the alseroxylon-minus-reserpine fraction and the synthetic alseroxylon mixture, with or without reserpine, indicate that reserpine does not contribute significantly to the pronounced antihypertensive activity of alseroxylon. Therapeutic implications of these findings are discussed. 110 pages. $2.00. Mic 57-1379

A COMPARATIVE STUDY OF THE EFFECTIVENESS OF SOME ALGINS AS DISINTEGRANTS IN TABLET MANUFACTURE

(Publication No. 19,433)

Robert George Shaheen, Ph.D.
Purdue University, 1956

Major Professor: H. George DeKay

Although the United States Pharmacopeia and National Formulary contain monographs for the active ingredients of the official tablets, including tests for identity, purity, assay procedures, and weight variation tolerances, no specific tablet formulas are provided. The formulation of these tablets is apparently at the discretion of each pharmaceutical manufacturer. Consequently, these tablet manufacturers are constantly in search of new and more efficient binding agents, lubricants, and disintegrating agents to be employed in their particular tablet formulations in order to provide a product of suitable hardness and of proper disintegration time.

It was with these facts in mind that some of the algins, (Kelacid, Calginate, Keltose, Kelcosol, and Kelcoloid HVF — all products of the Kelco Company of California) were evaluated as to their usefulness as:

(a) Disintegrating agents compared to starch
(b) Agents for overcoming the retardant action of magnesium stearate on disintegration
(c) Binders and/or disintegrants in specific combinations
(d) A means of retarding or controlling disintegration

These properties were evaluated in individual tablet formulations of Phenobarbital, Desiccated Liver, Sulfathiazole, Acetanilid, Ascorbic Acid, Magnesium Trisilicate, Sodium Salicylate, and Aluminum Hydroxide. The algins were studied in the concentrations of 1, 2, 5, 10, and 15 percent of the active ingredient. The tablets resulting from this study were evaluated on the basis of hardness, appearance, and disintegration time.

It was found that starch possessed maximum activity when utilized in 15 percent concentrations and added to the dried tablet granulation with the lubricant. Keltose added to the dry mix before the granulation process in 2 percent concentration possessed good disintegration qualities while Kelacid in quantities between 5 and 15 percent was effective when added to the dry mix before the granulation process. Fifteen percent Calginate was effective when added to the dry mix before the granulation process.

Magnesium stearate exhibited a retarding action on the disintegration of lactose-sucrose tablets which manifested itself in a two plateau curve with critical values at 0.5 and 1.5 percent of magnesium stearate. Actions similar to those above were recorded for the algins examined in this study.

Tablets were prepared successfully using combinations of algins as binders and/or disintegrators.

The algins, Kelcosol and Kelcoloid HVF, were tested for retardant effect on disintegration and revealed properties when employed in high concentrations and in alkaline media. This property was more pronounced and uniform with water insoluble tablet ingredients. It can be concluded that the primary factors which influence the mechanism of disintegration of tablets are:

(a) the nature of the tablet ingredients
(b) the nature of the disintegrant
(c) the quantity of the disintegrant employed
(d) whether the disintegrant was added before or after the granulation process
(e) nature and quantity of granulating or binding agent employed. 120 pages. $2.00. Mic 57-1380

A STUDY OF THE USE OF IONIZING RADIATION SOURCES IN PHARMACOLOGICAL TESTING METHODS

(Publication No. 19,441)

Charles Anthony Walton, Ph.D.
Purdue University, 1956

Major Professor: Tom S. Miya

In the pharmacological testing of two major groups of drugs, namely the antispasmodics and the hypotensives, considerable difficulty is encountered in interpretation of responses because of the inadequacy of most technics for simultaneous evaluation of both peak and duration of activity. In addition, usual procedures for measuring smooth muscle activity employ displacement of muscle levers by the muscle and subsequent recording of such displacements on a smoked drum. This introduces additional difficulties because of the friction variations (hence, load variations) accompanying the recording.

A new technic of recording and measuring biological activity has been tested. The technic employs ionizing radiation sources in lieu of the usual writing point on heart levers and as additional apparatus on the top of the manometer levers employed in blood pressure determinations by the direct method. Geiger-Muller tubes are suspended immediately above the sources and register the displacement of the levers as a variation in the count from the radioactive source. Such a method of recording lever displacement embodies the peak of activity, duration of activity, and a representation of the character of the response curve in a single expression of drug action relative to the normal activity. Therefore, the measurement of the response is representative of the "area" of response rather than just the peak, or nadir.

Extensive testing of several species with the technic suggests that guinea pig ileum evidences considerable normal fluctuation in tonus and activity and therefore presents difficulty in obtaining reproducible results. Sufficient gross response can be obtained to adequately compare antispasmodics for example in rapid screening procedures. When determinations were made on the effectiveness of atropine in antagonizing the spasm of rabbit ileum induced with acetyl-beta-methylcholine chloride sufficient data were obtained to establish the ED_{50} for atropine with a standard deviation of only ±16.5%, a rather significant figure for this type of tissue under "in vitro" conditions, since, according to Vaughan Williams (1), "The chief difficulty has been, and still is, that the analytical method is hard to apply to so complex a tissue as the intestine."

Excellent results were obtained when the proposed technic was compared with the usual procedure of measuring the nadir obtained with the hypotensive drug, Veratrone.* When the slope was calculated for the dose-response relationship using nadir measurement as the criterion of response standard deviation obtained was ±44.9%. Calculation of the slope of the dose-response relationship using the ionizing radiation count data (as % Drug Count/Normal Count) presented a standard deviation of only ±6.08%.

The significance of the technic in pharmacological testing methods involving fragile tissues such as smooth muscle of gut, uterus, and arterial spiral is recognized. Further, it is a possibility that the technic could be utilized to develop a more accurate biological assay procedure in evaluating activity of hypotensive drugs.

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*Veratrum viride, Parke, Davis.

REFLECTION AND INTENTIONALITY

(Publication No. 19,001)

Robert Thomas Kirkpatrick, Ph.D.
Northwestern University, 1956

Directer: Professor Earle

Reflection is ordinarily considered a sort of "doubling back" of consciousness upon itself, a consciousness of consciousness. But if consciousness is defined as intentionality, as it is by Brentano, Husserl, Sartre and others, then the act of reflection is in need of explication. For intentionality is described, especially in the writings of Sartre, as a reaching out to something other than itself. Consciousness is always a consciousness of something which is not itself consciousness. How, then, can this consciousness, whose whole nature is exhausted in reaching out to something other than itself, ever "turn back" on itself? This is the problem of reflection.

The problem, when formulated in this way, depends on the prior claim that intentionality is irreducible, that the intentional terms which we constantly use in describing our experience cannot be defined in non-intentional terms. In order to point out the difficulties involved in the various attempts to do away with intentional terms, to "reduce" intentionality, the work of William James is discussed in some detail. Reasons are given for believing that James' reduction is a failure, and it is suggested that more recent attempts at reduction fail for similar reasons. Gilbert Ryle's attempt to "undercut" the problem is also found to be unsatisfactory. This criticism of the various attempts at reduction is based on the work of Roderick Chisholm.

The irreducibility of intentionality leaves us with the problem of reflection. Sartre's work on this problem is examined, and his distinction between "pure" and "impure" reflection is criticized. But a possible solution to the problem is found in Sartre's notion of "prereflexive consciousness." This solution, however, is obscured by Sartre's discussion of pure reflection, by his failure to explicate the special meaning which he gives to the terms "positional" and "nonpositional," and by his insistence on both the emptiness of consciousness and the certitude of the Cogito. The resulting ambiguity pervades Sartre's treatment of reflection.

In a critical discussion of Sartre, an effort is made to clarify the notion of prereflexive consciousness and to suggest the way in which prereflexive consciousness might come to "know" itself. The essential difficulty in Sartre's analysis is that the descriptions of prereflexive consciousness take place on the reflexive level — hence presuppose that very consciousness of consciousness which is in question. In opposition to Sartre, it is claimed that no special act of reflection is necessary. Instead, consciousness is exhausted in reaching out beyond itself, but in this very self-transcendency it finds itself. A phenomenological description of pragmatic, desiderative, affective, and cognitive consciousness reveals that the consciousness of consciousness is present in the consciousness of objects. Reflection is not a special act by which consciousness somehow "doubles back" on itself. It is simply the consciousness of consciousness which is present in the explicit consciousness of any object whatsoever.

202 pages. $2.65. Mic 57-1382

A CRITICAL EXAMINATION OF THE SYSTEMATIC PHILOSOPHY OF WILLIAM E. HOCKING

(Publication No. 18,754)

James L. Arnold Snedden, Ph.D.
The University of Buffalo, 1956

This study was undertaken because it was felt that accounts of contemporary American philosophy had not given sufficient attention to Professor Hocking's systematic philosophy. Too frequently he has been taken merely as a follower of Josiah Royce, rather than as an original thinker of noteworthy stature. While his chief interest, and therefore the major part of his writing, was given over to social and religious philosophy, the systematic thought underlying his work is a skilful attempt to reconcile spiritualistic idealism with the findings of empirical science and the insights of pragmatic philosophy.

Hocking maintains that both the objective (behavioral-physiological) and subjective (semi-phenomenological) methods of studying man must be employed. They are but different views of the same metaphysical entity: the self. Application of this, the principle of empirical duality as he calls it, leads to a metaphysical psychology of considerable complexity.

Hocking maintains that ideas are the instruments, not the objects in experiencing: they are thought with, not of. Each idea has a formal and an objective reality, the former as constituting a part of the 'apperceptive mass' with which the self thinks, the latter as denoting meaningfully some class of objects or actions. Thus in each experience, the body of ideas functions in two ways: cognitively, it is a more or less articulate system of knowledge all of which is used, (in varying degrees of relevance) to judge the meaning of the experience; evaluatively, it is a similar system of interests which determine the values involved in the experience. It is both 'understanding' and 'rational will.'

The most original thesis of Hocking's psychology is that this apperceptive mass does not grow by summation but rather by a process of progressive discrimination and articulation of parts within the framework of an 'inborn' and persistent idea of objective world-reality as a whole. Thus the unity of the self is both a fact and an aim: it is a function both of the degree to which the will is directed to coping with reality and of the adequacy of the understanding to reality.

Reason, then, becomes synonymous with the capacity to be objective in searching for the meanings of the world, society and oneself. Thereby Hocking offers his unique

solution of the Kantian antinomy between freedom and nature. The fundamental pattern of life is the alternation between reflection and excursion. In reflecting upon itself, the self objectifies the world also; through this only is the systematizing of understanding and interests effected and conditioned by the whole-idea of reality. Hereby the self is able to form its hope, to consider its possibilities, to criticize itself and its world, and to decide in freedom. It carries out its decisions in spatio-temporal nature through its body. This excursive self is that of objective psychology, subject to the causal order.

Hocking maintains that the organic will to live, reflected in the homeostatic principle, is the basis of motivation. On the ground of innate organic tendencies, habit systems arise through learning. He posits that a habit is the objective counterpart of idea, having no meaning until that idea is known.

Reason thus becomes the original agency whereby man remakes himself, his society and the natural world, building a community of freedom on the secure basis of the order of physical causality. Using a skilful restatement of the ontological argument, Hocking shows that realism at least is necessary: otherwise the distinction between subjective and objective experience would be meaningless. But he argues further that human community would be impossible unless this common natural reality were not also 'known to be known' by God. In this way he is able to develop a voluntaristic metaphysics which sees experience as a communication between God and man, cooperating in the creation of value. His initial realism becomes idealism.

Criticism is directed chiefly at this latter argument. Hocking's theory of time appears to be his most serious error, entailing his recourse to this semi-Berkeleyan idealism. It is attempted therefore to incorporate his epistemological insights into a metaphysics much like that of A. N. Whitehead. 327 pages. $4.20. Mic 57-1383

PHYSICS

PHYSICS, GENERAL

ELECTRONIC ENERGY BANDS IN IRON WITH APPLICATIONS TO FERROMAGNETISM

(Publication No. 20,110)

Joseph Callaway, Ph.D.
Princeton University, 1956

The method of orthogonalized plane waves (OPW) has been applied to a calculation of the electronic energy band structure of 3d and 4s electrons in α iron. A starting charge density was formed from superposed Hartree free atom charge densities for the d^6s^2 configuration of iron, arranged in the proper crystal lattice. The starting potential was computed from this, exchange effects for a non-magnetic state being included by Slater's free electron approximation to the exchange potential. The OPW method was found to break down for states of S like symmetry because the assumed Hartree core states are not eigenfunctions of the crystal potential. Two such states were studied by the cellular method. The OPW method was modified to improve the convergence for states of D symmetry. Convergent OPW expansions were obtained for nine states in the Brillouin Zone, and an interpolation scheme was used to extend these results to other states.

The width of the 3d band was calculated to be about two volts. The separation of the 3d levels at the center of the Brillouin Zone is considerably smaller than it is at the corners and faces of the zone. The charge density of the 3d electrons is more compact than that of the Hartree free atom field. This is due to the inclusion of exchange, and is in agreement with neutron diffraction experiments.

The relative position of the 4s and 3d bands is sensitive to the potential used and is apparently incorrectly given by the potential mentioned. The 4s band was predicted to be above the 3d band at all points. An improved potential was obtained by assuming seven 3d electrons instead of six and by recalculating the exchange potential on the basis of the Hartree-Fock equations. It was revealed that the Slater free electron approximation overestimates the exchange energy by about 15% for 3d electrons and by 20% for 4s electrons. The improvement in potential taken in first order perturbation theory placed the 4s level Γ_1 about 1.4 volts below the bottom of the 3d band.

Application was made to the theory of ferromagnetism by calculating from the Hartree-Fock equations the change in potential energy of a 3d electron when one 3d electron per atom reverses its spin. This energy was found to be between 1.23 and 1.58 volts. A density of states curve was calculated for the unmagnetized state, and the change in kinetic energy upon magnetization was computed to be .69 volts. This gives a tendency to ferromagnetism between .54 and .89 volts at absolute zero. This is considerably too large. Most of the error probably results from underestimation of the change in kinetic energy caused in turn by underestimation of the d band width.

The exchange splitting of the band structure was considered. Corresponding states of D symmetry are separated by a gap of the order of 3 volts, the S like levels Γ_1 are separated by about 1 volt. A total bandwidth of 4.1 volts from the bottom of the 4s band to the Fermi level in the 3d band (magnetized state) was obtained.

149 pages. $2.00. Mic 57-1384

ANALYSIS OF TWO PROBLEMS ARISING IN MEASUREMENTS OF HYDROGEN FINE STRUCTURE

(Publication No. 20,450)

John Martin Harriman, Ph.D.
Stanford University, 1957

Numerical Values for Hydrogen Fine Structure. Bethe's "average excitation potentials" for states 1s through 4p of hydrogen are calculated numerically. These lead to values of the $n_0{}^2S_{\frac{1}{2}} - n_0{}^2P_{\frac{1}{2}}$ level shifts in hydrogen for $n_0 = 3$ and 4 of $S_H(3) = 314.690 \pm 0.047$ Mc/sec and $S_H(4) = 132.998 \pm 0.020$ Mc/sec, which are 1.44 Mc/sec and 0.85 Mc/sec larger than previous estimates. For $n_0 = 2$, a value of $S_H(2) = 1057.21 \pm 0.16$ Mc/sec is obtained, which is in close agreement with previous calculation. In conjunction with this work, the oscillator strengths $f(n_0\ell_0, n\ell)$ are tabulated for $n_0 = 1$, 2, 3, and 4. A generalization of the Wigner-Kirkwood sum rule is derived. Results are reported in Phys. Rev. 101, 594 (1956).

Franck-Condon Principle for Proton Production from Molecular Hydrogen. Numerical calculations are made of the overlap integral for transitions by electron collision from the molecular ground state to both attractive and repulsive states of the hydrogen molecular ion at energies above dissociation. An Airy integral form of the WKB approximation is used for the wave function of the molecular ion in the continuum. Results show that of the ions formed in the attractive state 4.4% dissociate into $H + H^+$ with half the product pairs sharing kinetic energy of 0.43 ev. or more. Overlap integrals calculated for linear potentials are found to be insensitive to potential slope. This suggests the Winans-Stueckelberg approximation which is compared with the exact calculations and shows good agreement, yielding for the attractive state an estimate of 4.47% dissociation with a mean energy of 0.51 ev. A linear potential is assumed for the repulsive state. Results have been submitted for publication in The Physical Review. 54 pages. $2.00. Mic 57-1385

ENERGY LOSS AND STRAGGLING OF RELATIVISTIC CHARGED PARTICLES

(Publication No. 20,453)

Alvin Maynard Hudson, Ph.D.
Stanford University, 1957

Two experiments measuring the most probable energy loss and the straggling distribution of relativistic charged particles have been carried out. One experiment utilized 150-Mev electrons from the Stanford Mark III linear electron accelerator with thin (≈ 2.5 g/cm^2) targets of Li, Be, C, and Al. The other experiment used sea-level, cosmic-ray mu-mesons and measured the energy loss and straggling in a two-inch scintillation crystal of NaI(Tl) for the integrated meson energy spectrum. When suitable corrections were made for the density effect, both experiments showed agreement with the Landau theory for the most probable energy loss but the widths of the straggling distributions were wider than the theory would predict, particularly in the electron experiment where the measured half-widths were from 7% to 15% too wide.
89 pages. $2.00. Mic 57-1386

ANALYSIS OF A RESONANT-CAVITY MEASUREMENT OF THE VELOCITY OF LIGHT

(Publication No. 20,456)

Donald Herbert Janney, Ph.D.
Stanford University, 1957

Methods of overcoming the major sources of uncertainty in the Hansen-Bol [K. Bol, Phys. Rev. 80, 298 (1950); K. Bol, Ph.D. thesis, Stanford University, 1950] and Essen [L. Essen, Proc. Roy. Soc. (London) A204, 260 (1950)] measurements of the velocity of light by microwave resonant cavities have been analyzed by theory or experiment and the potential accuracy of this type of measurement has been evaluated.

The procedure given by Helmer [J. C. Helmer, Engineer's thesis, Stanford University, 1954] to eliminate the effects of dimensional imperfections in the cavity has been extended. This experiment uses a cavity consisting of a circular cylinder of variable length. The velocity of propagation can be deduced from measurements of a single change in cavity length and the resonant frequencies of several modes.

The effect of a non-vanishing cavity surface impedance has been analyzed theoretically. The Q-correction which is usually used to relate the measured frequencies to the frequencies of a lossless resonator of the same dimensions is not valid for the general case in which the real and imaginary parts of the surface impedance are unequal. Specifically, the surface reactance must be known. No independent experiment is presently available for measuring the surface reactance with the desired accuracy.

A combination of theory and experiment has been used to show that if the resonant frequencies are in the range of 2000 Mc to 4000 Mc the cavity length changes can be measured interferometrically with an uncertainty of about 3 parts in 10^7.

At the specified frequencies the low-order TE_{0mn} modes will have Q's in the range of 50,000 to 100,000, hence the resonant frequencies can probably be detected with an uncertainty of about 1 to 2 parts in 10^7. Thus, length and frequency measurements do not preclude an uncertainty in the velocity of propagation of 1 part in 10^6.

The measurement of the surface reactance limits the accuracy of the experiment. Unless this difficulty can be overcome, either by direct measurement or by use of several modes, no resonant cavity measurement of the velocity of light can have an uncertainty of less than 2 or 3 parts in 10^6.

Several experiments which eliminate the effects of a non-vanishing surface impedance have been analyzed theoretically and have been found to have an excessively large final uncertainty.

Two subsidiary problems have been considered. One problem was a theoretical analysis of the effects of modes close to the one on which measurements are made, and the other was a brief experimental investigation of methods of electroforming high-Q cavities.
134 pages. $2.00. Mic 57-1387

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

AN EXTENSION OF THE CONDENSATION THEORY OF YANG AND LEE TO THE PRESSURE ENSEMBLE

(Publication No. 19,010)

Marvin Burton Lewis, Ph.D.
Northwestern University, 1956

Director: Professor A. J. F. Siegert

Yang and Lee[1] have given a function theoretical description of phase changes in terms of the roots of the grand partition function. They have shown that the pressure and the average density are analytic functions of the fugacity in any strip of the complex fugacity plane that contains the real axis and which remains free of the roots of the grand partition function. Therefore, phase changes can only occur, if in the limit of infinite systems, roots of the grand partition function crowd onto the real fugacity axis.

Yang[2] has pointed out that the pressure they use is not the average pressure in the grand canonical ensemble; that is, the average of the canonical pressure over the distribution of the number of particles, but is the latter, averaged once again over the volume from zero to the actual volume of the system. This doubly averaged pressure has no immediate physical meaning for finite volume, but is used by Yang and Lee only in the limit of infinite systems. While there is little doubt that the two definitions become equivalent in the limit, a rigorous proof of this equivalence does not exist, and a proof would have to be based on the limit properties of the canonical partition function.

Since some of the advantage of the use of the grand canonical ensemble is thus lost, if one requires a proof of the equivalence of the two pressures in the limit, it seemed of interest to rigorize a variant of the Yang-Lee theory suggested by A. J. F. Siegert.[3] The conceptual and physical advantage of this variant is that it deals with quantities (pressure and volume) which have immediate physical meaning for infinite and finite systems. This variant starts with a canonical ensemble whose elements are the system of interest and a mechanical system used as a pressure gauge; that is, a pressure ensemble.

In the pressure ensemble, the Laplace transform $C_N(S)$ of the canonical partition $Q_N(V)$ plays a role analogous to that of the grand partition function in the original Yang-Lee theory. The average volume per particle is given by $\bar{v}_N(S) = -\frac{1}{N}\frac{\partial}{\partial S}\ln C_N(S)$. Since the $C_N(S)$ are analytic if they exist, the only singularities of $\bar{v}_N(S)$, at finite N, are caused by roots of $C_N(S)$. We expect, therefore, that phase changes can be described by the closing in of roots of $C_N(S)$ onto the real posivie S axis.

To rigorize this variant, we must prove that

$$\lim_{N\to\infty} \bar{v}_N(S)$$

exists and is an analytic function in those regions of the complex S plane that are free of roots of $C_N(S)$ and that contain a segment of the real positive S axis bounded away from zero. To do this, we first prove the existence of

$$C(S) \equiv \lim_{N\to\infty} \frac{1}{N}\ln C_N(S)$$

for real positive S. This is a physical problem; it states that the Gibbs potential per particle exists for the infinite system. The proof is based on the results of van Hove[4] concerning limit properties of the canonical partition function. With this limit existing on the real S axis, we can continue into the complex S plane and obtain the desired results by means of the Vitali convergence theorem.[5]

We have then the following results: phase changes which occur at or lead to a specific volume larger than the minimum specific volume can be described by roots of the Laplace transform $C_N(S)$ of the canonical partition function. For a special model (molecules whose incompressible cores are oriented cubes) a phase transition leading to the minimum specific volume at constant pressure is proved impossible. 54 pages. $2.00. Mic 57-1388

BLOCH DECAYS IN SOLIDS

(Publication No. 20,756)

Irving Jack Lowe, Ph.D.
Washington University, 1957

Chairman: Richard E. Norberg

It is found by the author that Bloch decays in rigid solids (such as the F^{19} Bloch decays in CaF_2) are not monotonic but have a series of maxima and minima. To explain this phenomenon, a general theory of Bloch decays is developed, which is then specialized to rigid solids.

Using time dependent quantum statistical theory, the relationship

$$\overline{\langle \mu x(t)\rangle} = \frac{\mathrm{Tr}\left(e^{\frac{-itw\,H_2'}{\hbar}} e^{\frac{-H}{kT}} e^{\frac{itw\,H_2'}{\hbar}} R_{op}^{+}(tw)\, e^{\frac{it\,H}{\hbar}} R_{op}(tw)\right)}{\mathrm{Tr}\left(e^{-H/kT}\right)} \quad (1)$$

is derived to describe Bloch decays in solids, liquids and gases under any conditions with any type of interaction between the particles of the sample.

$\overline{\langle \mu x(t)\rangle}$ = microscopic magnetization after a "$\frac{\pi}{2}$" r. f. pulse
T = temperature of sample
H = complete Hamiltonian of sample
H_2' = all non-magnetic terms of Hamiltonian
$R_{op}(tw) = e^{i\gamma H_0 tw S_z} e^{i\frac{\pi}{2}S_y}$
H_0 = applied static magnetic field
S = total spin operator for particles being examined
γ = gyromagnetic ratio of particles being examined
t_w = length of time "$\frac{\pi}{2}$" r.f. pulse is applied. t_w is assumed short enough that no appreciable dephasing of the spins takes place while the pulse is applied.

On the basis of equation (1), it is shown that for $\frac{\gamma \hbar H_0}{k T} << 1$, the Fourier transform of the spectral density function for the sample under the same physical conditions is identical to $\frac{\overline{\langle \mu x(t)\rangle}}{\mu'(o)}$ where $\mu'(o)$ is the macroscopic magnetization of the sample before the application of the "$\frac{\pi}{2}$" r.f. pulse.

Equation (1) is evaluated for the following conditions: (a) the sample contains only one nuclear species with a magnetic moment, this species having an angular momentum $\frac{1}{2}\hbar$.

(b) The magnetic interaction terms of the Hamiltonian $= H_1 = \sum_{j<k} (A_{jk} \vec{S}_j \cdot \vec{S}_k + B_{jk} S_{jz} S_{kz})$

(c) H_1 commute with all other terms in the Hamintonian. The evaluated $\overline{\langle \mu x(t) \rangle}$ is only rigorously correct however for terms up to t^4. The results are found to check exactly with the results predicted by Van Vleck for $\langle \Delta \nu^2 \rangle$ and $\langle \Delta \nu^4 \rangle$

A classical model is described which gives the same results as the evaluated $\overline{\langle \mu x(t) \rangle}$ for the case $A_{jk} = 0$ for all j and k. It is then shown that the assumption of a gaussian distribution of magnetic inhomogeneities at the lattice sites is not valid in a rigid solid.

$\overline{\langle \mu x(t) \rangle}$ is evaluated for the case of F^{19} Bloch decays in a single crystal of CaF_2 for $\vec{H}_0$ along the [1,0,0], [1,1,0] and [1,1,1] crystalline axes. Excellent agreement is found between the calculated and experimental Bloch decay shapes. Excellent agreement is also found for the experimental Bloch decay shapes of F^{19} in CaF_2 and the Fourier transform of c.w. lines of CaF_2.

122 pages. $2.00. Mic 57-1389

GEOMAGNETIC SECULAR VARIATION* (PARTS I AND II)

(Publication No. 18,701)

Keith Leon McDonald, Ph.D.
University of Utah, 1956

Chairman: Walter M. Elsasser

The geomagnetic secular variation is attributed to the distortion of the main magnetic field within the earth's core by convective motions. The hydromagnetic effects at the core-boundary may be correlated with the observed field at the earth's surface by extrapolating this field to the surface of the core. From maps of the geomagnetic secular variation, the time derivative of the radial component of the magnetic intensity is extrapolated to this surface on the basis of potential theory for an insulating mantle (the distribution of electrical conductivity throughout the mantle is treated later). A quantitative description is given of the topography of the magnetic field variation at the core surface. Although the projection is carried out here in terms of circular hills and dales, it is found that the magnetic topography at the core is far better described in terms of an extensive system of long ridges, sometimes radiating out from a set of focal points. Frequently, a near-illusion of the existence of hills or valleys is brought about by neighboring ridges. A typical ridge has a half-width of from 150 to 600 km at the core and extends over several thousand kilometers, being paralleled by ridges of opposite sign. The maximum heights of the ridges frequently occur at large distances from the focal points. The integrated effects at the core are such that, for an insulating mantle, radial intensities of 2 to 5 gauss are common, whereas intensities ranging from 5 to 15 gauss occur in the more active regions. A lower limit of the total root-mean-square value of the time derivative of the vertical component at the core is estimated to be 0.18($\pm$0.05) gauss per year.

An improved extrapolation requires a knowledge of the electrical conductivity σ throughout the mantle. This function has been roughly inferred only to about the 800 km depth from the geomagnetic transient variations (B. N. Lahiri and A. T. Price, Phil. Trans. R. Soc. A., 237, 509 1939). To compute σ throughout the remaining portion of the mantle we make use of the large wave periods which characterize the geomagnetic secular variation. Choosing a power law for σ ($= \sigma_0 \rho^{-\gamma}$, where $\rho = r/Rc$ and Rc is the core radius) the equations are integrated in terms of Bessel functions. The wave attenuations and phase retardations, after propagation through the mantle, are thereby obtained for sinusoidal input functions. A comparison of the ratios of the derived harmonic components with those observed at the earth's surface suffices to determine γ. The method has the advantage of combining a large amount of data so that the instantaneous details of the field at the core are incidental.

Aperiodic input functions at the core are solved by the method of Laplace transforms and an ordinary discontinuity in H_r (δ-function in H_r) is treated in detail. The elapsed time for a pulse to reach the earth's surface is expressed in terms of the conductivity σ_0 at the core-mantle boundary. From a study of magnetic observatory records, σ_0 is thus computed. The bulk of the electrical conductivity throughout the lower 2/3 portion of the mantle is approximately $\sigma \doteq 1.2\ \bar{\rho}^{5.7} \times 10^2$ ohm^{-1}/meter.

104 pages. $2.00. Mic 57-1390

*Research supported by the U.S. Office of Naval Research.

ON THE STRUCTURE AND ELECTRICAL PROPERTIES OF EVAPORATED MULTIPLE LAYER THIN FILMS AND RELATED EXPERIMENTS ON DIFFUSION OF INDIUM AND ANTIMONY THROUGH INDIUM ANTIMONIDE FILMS

(Publication No. 19,592)

James Dana Richards, Ph.D.
Northwestern University, 1956

Adviser: Professor J.C.M. Brentano

Part I. In extension of work reported earlier[1] multiple layers were prepared by successive evaporations of two different metals in a moderately high vacuum (10^{-6} mm Hg.). Of several binary combinations tried, iron and lead yielded layers having the highest electrical stability and therefore received the most extensive examination. The electrical conductance of the lyaers parallel to the support was investigated under vacuum as a function of temperature and as a function of applied potential. All of the Fe-Pb layers examined exhibited negative temperature coefficients of resistance, at least at temperatures somewhat below room temperature. Single layers of iron and lead of comparable thickness and deposited under similar conditions behaved much more like the bulk metals. No

deviations from Ohm's Law were observed for the multiple layers even for a layer cooled by liquid helium and subjected to large pulsed fields (1000 volts per centimeter). The electrical behavior is discussed in terms of different models.

The effect on the conductance of the adsorption of residual gas was studied as a function of the pressure. At pressure below $\sim 10^{-2}$ mm Hg, gas is chemisorbed on the surface resulting in an increase of conductance. At higher pressures oxides form, as was evidenced by a large decrease of conductance.

Part II. In multiple layers of indium and antimony, the formation of the intermetallic compound InSb during the deposit is indicated by a decrease of conductance of the layer due to large differences between the conductivities of the compound and the separate metals. This decrease of conductance makes it possible to investigate the rates of formation of InSb and consequently the rates of diffusion of In and Sb through a thin growing layer of InSb. The analysis leads to values for both In and Sb of the product of the diffusion coefficient times difference in concentration of diffusing metal at the surfaces of the InSb layer. Diffusion was observed to occur much more rapidly in porous than in dense films. The mechanism by which the conductance of the layer is decreased by the formation of InSb is discussed and it is concluded that the base layers possess a more or less porous structure.

Part III. Additional experiments are briefly reported in which InSb layers were formed by the simultaneous deposition of In and Sb. On the basis of electrical conductivity measurements as a function of temperature, these layers consisted of very pure InSb, at least in the regions of the film possessing the highest resistance where, apparently, stoichiometric balance was automatically achieved.

Films of In which were deposited on liquid nitrogen cooled Pyrex exhibited irreversible changes of conductance when first warmed to room temperature. Reversible behavior was observed at temperatures below the highest temperature previously reached. The results are discussed and the findings of Coslett[2] are given a modified interpretation. 117 pages. $2.00. Mic 57-1391

1. Brentano, J. C. M. and Richards, J. D., Phys. Rev. 95, 841-843 (1954).

2. Coslett, V. E., Proc. Phys. Soc. London 49, 121-133 (1937).

STUDIES IN HYDROMAGNETIC THEORY (PARTS I-IV)

(Publication No. 17,580)

Donald E. Skabelund, Ph.D.
University of Utah, 1956

Chairman: Walter M. Elsasser

An unbounded ideal incompressible fluid is assumed throughout. The superposition of hydromagnetic waves of finite amplitude in a homogeneous primary field is investigated. Waves propagating in opposite directions and obeying the superposition principle prove to be of two types: parallel plane-waves and waves not necessarily plane but polarized. The existence of hydromagnetic waves in an inhomogeneous primary field is considered. When conditions are such that there is no reflection, the general solution is obtained, and the wave-field is found to propagate as though embedded in an imaginary fluid.

An investigation is made of energy relations in hydromagnetics, with particular attention being paid to the transport of energy. Application to energy flow in hydromagnetic waves reveals that the energy, in general, does not flow along the field.

A study is made of the hydromagnetic induction equation with finite conductivity. A partial integration is found possible in a linear velocity shear or when the magnetic Reynolds number is large compared to unity. To complete this integration or to integrate the induction equation when the velocity does not vary in the direction of the field leads to the "substantial diffusion equation." The integration of this equation is reduced to solving a Fredholm integral equation.

Numerous relations of general interest for a Lagrangian description of fluid flow are obtained.

126 pages. $2.00. Mic 57-1392

SINGLE-PHOTON ANNIHILATION OF POSITRONS WITH ELECTRONS

(Publication No. 20,765)

James Arthur Whalen, Ph.D.
Washington University, 1957

Chairman: Dr. T. A. Pond

Single-photon annihilation of a positron with an electron occurs in the presence of an atomic nucleus whose function is to absorb the momentum released in the annihilation process. The electrons of a given atom which participate in this process are predominately those in the K shell because of their greater probability of being near the nucleus.

This experiment demands that an annihilation between a positron and a K electron in Pb reveal itself as a coincidence between the annihilation gamma ray and the K x-ray emitted as the Pb atom returns to its normal state through transition of an electron to the vacancy in the K shell.

A lens beta-ray spectrometer selects in energy the positrons emitted from Na^{22} and focuses about 6000 per sec. on a Pb foil whose thickness of 110 mg/cm^2 slightly exceeds the positron range. Directly behind the foil is the x-ray detector, a NaI(Tl) scintillation crystal 0.70 in. square by 0.039 in. thick. A Lucite light pipe which extends out of the vacuum chamber through an O-ring seal optically couples this crystal to a Dumont 6292 photomultiplier tube. The detector of the annihilation gamma rays is a 1.5 in. diameter by 2 in. long cylindrical NaI(Tl) crystal and photomultiplier, both outside the vacuum chamber.

The outputs from both tubes are amplified. On these amplified signals pulse-height discriminators perform energy selection of the x-ray line (76 kev) in the former, and of the annihilation-photon region in the latter. Because of the extremely small intensity the latter accepts the total spectrum of single-photon annihilations which occurs as the positrons stop in Pb.

The background coincidence rate is taken to be that which occurs when the Pb foil is replaced by an Aℓ foil of 64.4 mg/cm^2 thickness or, alternatively, when the Aℓ foil is interposed between the positrons and the Pb. Since the energy selection is left unchanged, no Aℓ x-rays are detected and so no coincidences of the one-photon type can occur.

Since the differences between the Pb and Aℓ coincidence rates is about 0.1 counts/min in the presence of a background of about the same magnitude, the accumulation of a statistically significant number of counts requires approximately a week. Throughout such a run coincidence and singles counts are recorded for hour-long periods alternating between Pb and Aℓ, and energy calibrations are checked and discriminator settings reset every four to six hours. Counts and their time intervals are summed over the entire run rejecting data recorded during periods in which a change of $\gtrsim 5\%$ in any one of the following: calibration, discriminator settings, or singles rates for either channel.

The Pb-Aℓ difference rate is shown not to be caused by the other evident sources of coincidences: spurious noise pulses, cosmic rays, gamma rays scattered from one detector to the other, random-sum coincidences, or two-photon annihilation with either free or K-shell electrons.

On the other hand, this Pb-Aℓ rate is consistent with interpretation as one-photon annihilation as follows: it exists only when positrons stop in the foils; it exists only when the Pb K x-ray is accepted by the x-ray detector; it shows the proper dependence on the selection of the energy range of the annihilation photons by the gamma-ray detector; it is linearly dependent on the solid angle of the gamma detector; it is independent of the atomic number of the background foil (provided the background x-ray is not selected); and it is reproducible throughout seventeen consecutive measurements spanning seven months and varying experimental conditions.

On the basis of the above evidence the Pb-Aℓ rate is interpreted as the detection of single photon annihilation.

Finally these results for Pb show very good agreement with the energy dependence of the theoretical cross-section.[1] Although they point to an absolute value of the cross-section which is 1.42 times the theoretical value, the disagreement is not outside the large experimental errors present in the absolute (but not in the relative) comparison. 92 pages. $2.00. Mic 57-1393

1. J. C. Jaeger and H. R. Hulme, Proc. Camb. Phil. Soc. 32 (1936), 158.

PHYSICS, ELECTRONICS AND ELECTRICITY

MASER OSCILLATORS

(Publication No. 20,451)

John Colville Helmer, Ph.D.
Stanford University, 1957

This report concerns a theoretical and experimental study of novel sources of microwave power, commonly referred to as the maser (microwave amplification by stimulated emission of radiation).

A theoretical analysis of the maser oscillator is presented which starts with the quantum mechanics of the ammonia molecule and produces the differential equations governing the coefficients of the energy eigenfunctions. From these equations, two theories are derived. One, a small signal theory, produces a new result in describing the effect of an arbitrary variation in the field amplitude on the molecular line width. The other, a large signal theory, shows the saturation effects in a beam in which the molecules have a Maxwell velocity distribution. A maximum average transition probability of 0.76 is predicted. The uni-velocity and Maxwell velocity theories are compared and it is shown that the introduction of the velocity distribution causes a region of stability to appear in the beam frequency pulling function. For any value of beam flux, the optimum loading of the cavity and the corresponding maximum power output is given.

The properties of the maser amplifier are briefly considered. It is shown that although a noise figure of 1 is theoretically possible, realistic considerations which permit the amplifier to have high power gain limit the noise figure to a value of 2.

A new approach to maser construction is considered. A focusing system is used to separate the energy states of the ammonia molecule, as in the Townes maser, but differs from it in mechanical details. For example, the focuser forms the extension of a liquid nitrogen cold trap which cools the two grounded electrodes. The cavity is a flexible cylindrical shell, open in both ends, and is tuned by elastic compression. To permit comparison of the theory with actual operation, a Pirani gauge has been used to determine the ammonia beam flux under operating conditions.

An experimental study has been made of the two masers constructed by the author at Stanford. Studies and measurements are presented which show the detailed behavior of the two oscillators. These were taken by observing changes in the beat note produced by the two oscillators and the rectified signal amplitude when the operating parameters were changed. A comparison with theory shows very good agreement with the small signal theory and reasonable agreement with the large signal theory. The predicted region of stability in the beam pulling function is not observed. The analysis of the measurements shows that complicating factors such as an asymmetry in the line shape and an unstable line center are present.

A molecular Q of $6.67.10^6$ was measured and a total molecular flux of 5.10^{14} molec./sec. cm^2 was obtained under operating conditions. Under favorable circumstances, a long term relative frequency stability of 1 part in 10^{13} per second was observed. The masers would operate continuously for 10 hours without defrosting.

The final conclusion is reached that in a general way the maser oscillator behaves as predicted by the theory. Not all elements of the behavior of the oscillator, however, can be predicted and further study of the mechanism of oscillation is needed to fully describe its operation.

90 pages. $2.00. Mic 57-1394

A BACTERIOLOGICAL TECHNIQUE FOR THE EXPERIMENTAL INVESTIGATION OF THE AGEING AND ELECTROSTATIC PRECIPITATION OF SUB-MICROSCOPIC AEROSOLS FROM IONIZED ATMOSPHERES

(Publication No. 20,455)

John Anthony Jamieson, Ph.D.
Stanford University, 1957

Over the past two decades, considerations of air hygiene, atomic fallout, and various industrial problems have stimulated interest in the behaviour of suspensions of fine particles in air. Such suspensions have come to be called aerosols.

This dissertation is concerned with the development of a sensitive technique for following the behaviour of aerosols whose particles are too small and insufficiently concentrated to be investigated by means of light scattering. Specifically, the technique has been used to follow variations in the electrical charges of such particles when they are exposed to small concentrations of unipolar air ions.

The technique makes use of bacteriophage as a tracer element. The bacteriophage, which are small, quasi-living organisms, will attack susceptible bacteria and leave visible evidence of their presence in the form of small holes in an otherwise uniform bacterial growth.

The sensitivity of this tracer technique is probably comparable to that of radioactive methods. Decontamination is simplified, since the bacteriophage have a half-life at room temperature of about two hours. The air-ion environment is not altered as it would be by radioactive methods.

The investigation has used particles of 0.2 to 0.5 microns average radius and the results indicate that particle discharging and charging by ion densities of 1,000 to 10,000 ions per $cm.^3$ is slow. Small effects upon electrostatic precipitation rates appear to be perceptible, however, and some evidence has been obtained which suggests that exposure to low ion densities may reduce the average charge of the aerosol, but that higher ion densities may cause actual charging of the particles.

Theoretical analyses of the phenomena agree fairly well with the experimental results. Statistical significance tests suggest that some further work should be done on the charging problem.

190 pages. $2.50. Mic 57-1395

INVESTIGATIONS AND APPLICATION OF THE CONTRAWOUND HELIX

(Publication No. 20,461)

John Ernest Nevins, Jr., Ph.D.
Stanford University, 1957

A slow-wave structure for application in traveling-wave tubes is the contrawound helix. This structure is the superposition of two tape helices which have been wound in opposite directions, overlapping every 180 degrees. Such a combination of two helices results in several additional symmetries which give rise to certain advantages over the single helix. Two slow-wave modes propagate along the structure. The fields associated with these modes are the sum of an aggregate of waves called space harmonics. The fundamental space harmonic of the symmetric mode has no axial magnetic field, while that of the antisymmetric mode has no axial electric field. The total amounts of electric and magnetic energy stored in the fields are equal, so that the fundamental space harmonic of the symmetric mode stores mostly electric energy, and the other space harmonics store mostly magnetic energy. This energy distribution produces larger fundamental space harmonic impedance, and smaller impedances for the other space harmonics, than for those of a comparable single-tape helix. The impedance, defined as $|E_z|^2/\beta^2 P$, is proportional to the coupling of the beam to the fields. The larger the impedance, the greater the gain per unit length.

The advantages of the contrawound helix are somewhat offset by increased dispersiveness, which limits the bandwidth of the structure when used in a traveling-wave-tube amplifier.

Two types of experiments were employed to verify the theoretical predictions. The first experiment was intended to measure the propagation constant and the impedance of the fundamental space harmonic of the symmetric mode. Reflection symmetry allows a length of helix to be terminated by conducting planes and made into a resonator. A resonator of this kind can be perturbed, and a measurement of the electric field strength and of the propagation constant can be obtained. The results of experiments of this type show that the magnitude of the impedance of the contrawound helix is larger than that of a single-tape helix, and is approximately that of the sheath helix. The contrawound helix was found to be more dispersive than had been predicted by theory. The results of several experiments with helices altered at the overlap indicated that the current approximation which was used in the analysis of Chodorow and Chu was not adequate.

The second series of experiments made use of the electron beam as a probe. An electron beam can be synchronized with the individual space harmonic, and its velocity can be measured. Interaction with the fields can result in two phenomena: backward wave oscillation, and zero output for a finite input signal. The conditions of voltage and current for these two phenomena provide information for the calculation of the space harmonic impedance. A number of the space harmonics of both modes were identified and their phase velocity measured. The fundamental and minus-one space-harmonic impedances were measured and found to disagree with calculated values for large values of ka.

The contrawound helix is but one of a class of structures that share the same symmetry properties. The ring-bar structure, a series of periodically spaced rings connected alternately by a bar every 180 degrees, has also been investigated. Its properties are comparable with those of the contrawound helix. It was found that the ring-bar structure was generally more dispersive, and had a larger impedance, than the contrawound helix.

The advantages of the contrawound helix circuit were successfully demonstrated by the design and operation of a high-power pulsed traveling-wave-tube amplifier.

128 pages. $2.00. Mic 57-1396

PHYSICS, METEOROLOGY

AN ANALYSIS OF SURFACE ENERGY EXCHANGE DURING THE ABLATION SEASON ON LEMON CREEK GLACIER ALASKA[1]

(Publication No. 20,384)

Richard Carleton Hubley, Ph.D.
University of Washington, 1956

The purpose of the present study has been to perform an empirical investigation of the energy transfer at an isothermal, melting snow surface and its relationship to observed meteorological parameters, using more refined instrumentation and methods of observation than were available in earlier, similar investigations by H. U. Sverdrup and C. C. Wallén.

The surface energy exchange is treated in three parts in this paper: 1) radiative energy transfer, 2) energy transfer by precipitation, and 3) energy transver by turbulence.

The thickness of the surface layer of snow through which absorption of solar radiation occurs is determined from measurements of intensities of visible radiation within the snow. Albedo values for the snow are computed from measurements of incoming and reflected solar radiation over the snow surface. The snow albedo is found to vary with solar altitude and cloudiness as well as with changes in physical characteristics of the snow. When long-wave radiation is considered along with solar radiation, it is found that during the ablation season, the diurnal net transfer of radiant energy to the melting snowpack is often greater when skies are overcast than when skies are clear. A comparison is made between the radiative energy transfer at the surface of a model glacier in the Juneau Ice Field, and a model glacier in the Alps.

It is shown that energy transfer to the snow by rain falling on an isothermal, melting snowpack is an insignificant part of the total energy transfer.

From measured and calculated values of net energy transfer at the snow surface, energy transfer by radiation, and energy transfer by rain, values of energy transfer by turbulence are determined for a series of selected observation periods. These values are used to calculate exchange coefficients. It is shown that by making a slight modification in the functional expression for heat transfer by turbulence from that used by Sverdrup and Wallén, it is possible to obtain a nearly invariant relationship between the heat transfer by turbulence, windspeed, and the vertical temperature distribution above the surface when an inversion is present.

It is found that turbulent transfer of heat is the most important factor in causing ablation on the Lemon Creek Glacier. This turbulent transfer of energy becomes very large during summer storm periods. As a result, the number of warm storms passing over the glacier in a single ablation season can largely determine whether the glacier will end the season with a positive or negative mass budget.

77 pages. $2.00. Mic 57-1397

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PHYSICS, NUCLEAR

THE TOTAL CROSS SECTIONS OF LIGHT ELEMENTS FOR NEUTRONS FROM ALPHA-PARTICLE INDUCED REACTIONS

(Publication No. 17,295)

Robert L. Becker, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor Henry H. Barschall

Two exoergic (α,n) reactions were investigated as possible neutron sources. Because of the difficulties inherent in deuteron acceleration, it was felt that (α,n) reactions might be more useful than the more conventional reaction, D(d,n), to produce neutrons of equivalent energy.

The reaction $C^{13} + \alpha \longrightarrow O^{17} + n + 2.201$ Mev should give monoergic neutrons, up to bombarding energies of about 5 Mev, since no known levels of O^{16} lie below 6 Mev. Neutrons from the reaction $Be^{9} + \alpha \longrightarrow C^{12} + n + 5.708$ Mev are not monoergic. Because of the excited state of C^{12} at 4.4 Mev, at least two groups of neutrons are always present. A detector may be built, however, which will be sensitive to only the most energetic neutrons.

To determine the usefulness of these (α,n) reactions as neutron sources, the total cross sections of several light elements were measured.

Beryllium, evaporated onto tungsten backings, was bombarded with He^{+} ions from an electrostatic generator. Neutrons in the most energetic group were produced with greatest abundance between bombarding energies of 2.0 and 3.0 Mev. These neutrons had energies between 7.6 and 8.6 Mev. In this range, neutrons with an energy between 4.4 and 5.6 Mev were produced.

Neutrons from C^{13} targets were detected by means of a scintillation detector which used a cylindrical plastic phosphor. The phosphor used for the Be neutrons was made of alternate layers of scintillation material and Lucite, to make the detector less sensitive to gamma-rays from the radiative decay of excited C^{12} nuclei.

Total cross sections of elements with atomic numbers between 3 and 9 were measured. Samples were prepared in elemental form for Li, Be, B, and C. Samples with two

different isotopic abundances were available for B. The transmission of BeO was measured relative to Be to determine the O cross sections. For F, the transmission of CF_2 was measured relative to C. Enough carbon was added to CH_3N_5 to make the C-H ratio the same as it is in paraffin, then the transmission of this sample was measured relative to paraffin. This gave the N cross section.

No resonances were observed in the cross sections of Li, Be, B, and B^{10}. Irregularities, indicative of energy levels of the compound nuclei, were seen in the cross sections of N and F, but were not believed to be completely resolved.

Resonances appeared in the carbon cross section at a neutron energy of 4.95 and 5.40 Mev. These resonances indicate levels in C^{13} at excitation energies of 9.32 and 9.93 Mev. Between 7.6 and 8.6 Mev, a broad peak is seen. The neutron yield from the $Be^9(\alpha,n)$ reaction indicates that there are at least 4 energy levels responsible for this irregularity.

Eight peaks in the total cross section of oxygen were observed. In addition, several peaks were observed in the neutron yield from the $C^{13}(\alpha,n)$ reaction, many of which were due to the same levels of the compound nucleus, O^{17}, that were responsible for the peaks seen in the total cross section of oxygen. These measurements indicate that levels in O^{17} occur at excitation energies of 8.06, 8.21, 8.35, 8.41, 8.47, 8.50, 8.71, 8.92, 8.97, and 9.20 Mev.

58 pages. $2.00. Mic 57-1398

A STUDY OF (d,p) REACTIONS ON TARGETS OF CHROMIUM, NICKEL, AND ZINC ISOTOPES

(Publication No. 20,750)

Alexander Joseph Elwyn, Ph.D.
Washington University, 1956

Chairman: Dr. Franklin B. Shull

This study deals with the measurement of the Q-values and angular distributions of the protons in (d,p) reactions on targets of isotopically enriched chromium, zinc, and nickel. Deuterons accelerated to 10 Mev by the Washington University cyclotron impinge on targets variously enriched in Cr^{52}, Cr^{53}, Zn^{64}, Zn^{66}, Zn^{67}, Zn^{68}, Ni^{58}, Ni^{60}, Ni^{61}, and Ni^{62}; these were in the form of oxides on a polyethylene foil backing placed at the center of a cylindrical reaction chamber. Protons are detected by a double proportional-counter telescope mounted on a movable arm outside of the chamber. Energy selection of the protons is accomplished by measuring their ranges in aluminum and using known range-energy relations.

Differential number-range spectra are obtained for each target isotope. The energies of the proton peaks on these spectra are calculated. The deuteron energy is obtained from the known $C^{12}(d,p)C^{13}$ ground state Q-value, and Q-values for the proton groups from the various targets are calculated. Angular distributions are measured for most of the observed groups, and ℓ_n-values are found by comparison with the theoretical curves of Butler.[1] Spin and parity values for the final nuclear states are determined where possible.

In presenting some conclusions from this study, it is worthwhile to draw on other investigations undertaken at this laboratory concerning the reactions $Ti^{47,48}(d,p)Ti^{48,49}$ [2] and $Fe^{56,57}(d,p)Fe^{57,58}$.[3] Certain trends with atomic number, Z, may be noticed.

For ground state reactions, the experimental angular distributions fit closely to theoretical curves for a single value of ℓ_n. This holds in the titanium isotopes ($\ell_n = 3$) where $f_{7/2}$ shell model orbitals are being filled, in chromium and iron ($\ell_n = 1$) where $p_{3/2}$ levels are being occupied, and in the nickel isotopes ($\ell_n = 1$), where $p_{3/2}$ levels are being filled. In $Zn^{64}(d,p)$ and $Zn^{66}(d,p)$ the ground state angular distributions are fitted best by a combination of $\ell_n = 1$ and $\ell_n = 3$; known low-lying excited states not resolved in this experiment have spins 3/2, as compared to 5/2 for the ground states in each case, explaining the observed ℓ_n combination. In $Zn^{67}(d,p)$, the distribution ($\ell_n = 3$) indicates closure of the $f_{5/2}$ level, while in $Zn^{68}(d,p)$ the experimental curves are fitted by $\ell_n = 1$, indicating the filling of the $p_{1/2}$ orbital.

For excited states more complex modes of excitation are expected from the point of view of a shall model because of the closure energy spacing. It is found that as Z increases from Ti to Zn the angular distributions of excited states are increasingly more difficult to fit with a single ℓ_n-value. Thus angular distributions are obtained that can only be fitted by a combination of ℓ_n values. There are examples, however, notably in the chromium isotopes in which single ℓ_n-values fit the angular distributions even for the excited states.

As Z increases, the angular position of the principal hump in the distribution increases. This behavior is consistent with what would be expected from modification due to Coulomb effects, which are neglected in the original theory. On the other hand, however, most investigations taking Coulomb effects into account have disclosed that the principal hump in the angular distribution is broadened as compared with the non-Coulombic case. This effect was not observed in this investigation.

Inconsistencies between measured ground state Q-values and the results from mass spectroscopic data[4] is noticed for some of the nickel and zinc isotopes. Consistent errors in our measurements cannot explain these differences. It is concluded, therefore, that the difficulty may be in the mass data itself.

159 pages. $2.10. Mic 57-1399

1. S. T. Butler, Proc. Roy. Soc. (London) 208A, 559 (1952).
2. M. M. Bretscher, Ph.D. Thesis, Washington U. (1954).
3. C. E. McFarland, Ph.D. Thesis, Washington U. (1955).
4. T. L. Collins, A. O. Nier, and W. H. Johnson, Phys. Rev. 86, 408 (1952).

ELECTROMAGNETIC PAIR PRODUCTION OF MU MESONS

(Publication No. 20,464)

George Heinrich Rawitscher, Ph.D.
Stanford University, 1957

The electromagnetic pair creation of spin 1/2 particles which possess an anomalous magnetic moment is

calculated in first Born approximation. The anomalous magnetic moment λ $e\hbar/2mc$ is described phenomenologically by inserting into the Dirac equation for the particle a Pauli term proportional to $\lambda F_{\mu\nu}\gamma_\mu\gamma_\nu$. The result is applied to the recently measured cross section for mu meson pair creation by gamma rays near threshold, and it is concluded that if the mu meson is a spin 1/2 particle, then its λ value lies between -0.4 and +0.2.

The high energy limit for the total cross section is estimated and indicates that all terms in the second and higher powers of increase quadratically with the photon energy.

In the second part of this dissertation the Fierz-Pauli theory of spin 3/2 particle is reviewed and the quantization procedure proposed by S. N. Gupta[23] is examined. It is shown that his method, which represents a natural extension of the spin 1/2 quantization, does not lead to a second-quantized solution of the Fierz-Pauli equation. The difficulty is connected to the presence of redundant components in the wave function. 113 pages. $2.00. Mic 57-1400

A CLOUD CHAMBER STUDY OF NEUTRON PRODUCTION BY PENETRATING μ MESONS AT SEA LEVEL

(Publication No. 20,762)

Brenton Fisk Stearns, Ph.D.
Washington University, 1956

Chairman: Robert D. Sard

This work is a study of the production of neutrons by sea-level μ mesons which penetrate a lead absorber. A cloud chamber with magnetic field above the absorber and a hodoscope array within and beneath it afford positive identification of unaccompanied penetrating μ mesons. The neutrons are thermalized by paraffin around the lead, and counted in delayed coincidence with particles passing through the cloud chamber by $B^{10}F_3$ proportional counter. The experimental result for the cross-section multiplicity product is $(22 \pm 8) \times 10^{-29}$ cm^2/nucleon for all processes by which a μ meson can produce neturons from lead nuclei. This result is analysed in terms of the known experimental photo-neutron yields. Not more than 15×10^{-29} cm^2/nucleon may be due to photons from knock-on showers. The contribution from the direct interaction of the electro-magnetic field of the μ meson, calculated using the Williams-Weizsacker approximation, is 9.5×10^{-29} cm^2/nucleon. The agreement of the theory with measurements presented here, and with work done underground, indicate that the theoretical methods are adequate, and that the underground results are correctly interpreted as being due to μ mesons.

Because of the large shower contribution, not much information may be obtained on the characteristics of the direct interactions. There is no evidence that the μ mesons lose large amounts of energy in the direct process, nor is there evidence that they undergo any anomalous scattering. The agreement of the measured and calculated results makes it unlikely that there is any significant amount of nucleonic cascade development. Many protons are seen to interact in the absorber. Very few of them produce penetrating secondaries in the interactions, in agreement with the results of Mylroi and Wilson. The protons must, however, produce a large nucleonic cascade, as the measured neutron multiplicity is greater than fifty. 102 pages. $2.00. Mic 57-1401

DIFFERENTIAL CROSS SECTIONS FOR HIGH ENERGY PHOTODISINTEGRATION OF THE DEUTERON AT 11.5°, 100°, AND 175.6° IN CENTER OF MASS SYSTEM

(Publication No. 19,439)

Clement Austin Tatro, Ph.D.
Purdue University, 1956

Major Professor: Randall M. Whaley

Measurements of the differential cross sections for disintegration of the deuteron by X-rays in the energy range 160-230 Mev, at center of mass angles of 11.5°, 100°, and 175.6° are described.

A magnet was used to turn the protons away from the X-ray beam. Detection of the protons was by means of a counter telescope. The method of reducing the counter telescope data to yield the proton counting rate is completely described. A liquid deuterium target was employed as the source of target deuterons.

Essential agreement with predictions based on work of other experimenters was obtained except for the measurements at 175.6° c.m. Here, the measured cross sections are higher than those obtained by using an assumed form for the angular distribution, forming a best fit to data taken at angles in the middle two-thirds of the angular distribution, and extrapolating to the extreme angles. The discrepancy at this backward angle is slightly greater than a factor of 2 from some of the published data where the extrapolation techniques were used.

Some speculation upon the validity of the simple three parameter form assumed by others for angular distribution was made. Granting the correctness of these measurements, and the correctness of those made by others at more central angles, it appears unlikely that this simple form can accurately describe the angular distribution in the 200 Mev X-ray region.111 pages. $2.00. Mic 57-1402

MEASUREMENT OF THE RADIATIVE CORRECTION TO ELECTRON-PROTON SCATTERING BY OBSERVATION OF THE ABSOLUTE CROSS SECTION

(Publication No. 20,468)

George Wilson Tautfest, Ph.D.
Stanford University, 1957

The scattering of 139.5-Mev electrons by hydrogen gas at one atmosphere pressure has been investigated using photographic emulsions. The beam of electrons from the Stanford Mark III linear accelerator, collimated to a diameter of 1/16 in., passes through the gas and is collected in a lead Faraday cup. Ilford C-2 emulsions, 50-μ thick,

which are arranged symmetrically about the beam, detect the recoil protons. Measurements of the recoil angle and the range in the emulsion are made on the proton tracks. Only those tracks are accepted whose measured range and angle correlate within $\pm$ 2.33 standard deviations of the distribution about the elastic kinematic range-angle curve calculated from the multiple scattering in the emulsion and the uncertainty in angle measurement. A total of 2359 tracks have been tabulated in the angular interval $54^0 \leqslant \gamma \leqslant 78^0$ giving a statistical error matching the systematic errors in plate geometry, beam integration, and track measurement. The results are compared with the Rosenbluth cross section integrated over the interval, corrected for the finite size of the proton and for the inclusion of radiative events. The value obtained is

$$\frac{\sigma_{exp}}{\sigma_{theor}} = 0.988 \pm 0.0209 ,$$

using a proton radius of 7.7×10^{-14} cm and including a 2.74-percent radiative correction.

93 pages. $2.00. Mic 57-1403

THE TENSOR FORCE AND ITS EFFECTS IN Li^6 AND N^{14}

(Publication No. 20,496)

James Edward Turner, Ph.D.
Vanderbilt University, 1956

Supervisor: Ingram Bloch

Certain perturbation matrix elements are investigated for the tensor interaction

$$\sum_{k>j=1}^{A} J(r_{kj}) \left[\frac{3 \vec{\sigma}_k \cdot \vec{r}_{kj} \, \vec{\sigma}_j \cdot \vec{r}_{kj}}{r_{kj}^2} - \vec{\sigma}_k \cdot \vec{\sigma}_j \right] ,$$

in which $J(r_{kj})$ is any scalar function. It is shown for the case of A identical particles that this operator has zero matrix elements between any states (1) which are made up of doubly occupied single-particle space states, and (2) which are made up of doubly occupied single-particle space states plus one other single-particle state. For neutrons and protons the general form of the perturbation matrix elements between states corresponding to almost-closed shells (shells filled except for one vacant single-particle state) for both types of particle is worked out. This matrix element form is applied to the ground level of N^{14}. It is shown that the N^{14} ground-level matrix elements are identical with those of Li^6 for the tensor interaction. It follows that the relative splittings of the unperturbed ground-level energy for these two nuclei in a perturbation calculation due to the tensor force are identical. Calculations are carried out for the Li^6-N^{14} case taking the unperturbed Hamiltonian to be that for a set of A noninteracting single-particle harmonic oscillators of equal strengths. The level spacing for the unperturbed oscillators is estimated from a consideration of the energy of maximum cross section for the nuclear (γ,n) reaction, and is found to be of the order of 25 Mev for Li^6 and N^{14}. The tensor well $J(r_{kj})$ is given a harmonic-oscillator shape with the purpose of trying to compensate in the calculation of matrix elements for the unrealistically fast falling off with increasing r of the radial part of the unperturbed energy eigenfunctions. For energy-level separations of the observed order of magnitude in the level structures of Li^6 and N^{14} (a few Mev) it is shown that one needs in this calculation essentially the same two-nucleon interaction strength for the tensor force as in the case of the deuteron. It turns out that the calculated total angular momenta, parities, total spin angular momenta, and mixtures of total orbital angular momenta for the two nuclei going with a given energy level are identical. The rather large spacing of the unperturbed energy levels (25 Mev) causes second- and higher-order corrections to be relatively unimportant. The calculation therefore yields essentially the same level structure for Li^6 and N^{14}. The unperturbed ground level splits into eight distinct levels with the perturbation present. The perturbed ground state is a mixture of 32% $^3S_1$ and 68% $^3D_1$. This gives the observed total angular momentum of the Li^6 and N^{14} ground states, but the calculated percentages of S and D states correspond to neither the Li^6 nor the N^{14} observed magnetic moment. All other calculated levels except the one in which the S and D states are admixed with percentages opposite to those of the ground state correspond to pure LS coupling. In this calculation configuration interaction plays a relatively unimportant role, following from the fact that the unperturbed energy levels are widely spaced. The near identity of the Li^6 and N^{14} level structures (which differ only in the relatively small second- and higher-order corrections) suggests the necessity of introducing an additional internucleon perturbation. A qualitative consideration of some of the effects of including the Majorana operator is given. In addition to the Li^6-N^{14} calculation the general problem of relating perturbation calculations for a translation-invariant operator in the representation of single-particle energy eigenfunctions to calculations for the operator in the representation of normal-mode energy eigenfunctions is treated. For the case in which all single-particle and internucleon forces, respectively, are equal, it is shown that the first-order results are the same in both representations. In general, higher-order energy corrections and the amounts of configuration interaction will be different in the single-particle and normal-mode representations.

114 pages. $2.00. Mic 57-1404

EFFECTS OF RADIATION ON THE HILL REACTION

(Publication No. 17,562)

Donald Rex Anderson, Ph.D.
University of Utah, 1956

Chairman: Dr. John D. Spikes

One of the greatest problems facing our civilization is the matter of insuring an adequate energy supply. Solar energy, which is available in enormous quantities, is presently being utilized to only a very slight extent. The only practical technique for the utilization of solar energy at present is the photosynthesis process as carried out by green plants. It would appear then that studies on the mechanisms of photosynthesis might be one of the best approaches for the development of better methods of utilizing solar energy.

The Hill reaction (photolysis of water by isolated chloroplast fragments) represents that portion of photosynthesis in which the radiant energy is actually transformed into useful chemical bond energy. This obviously is the most important phase of the problem to investigate.

One of the most powerful techniques for studying the mechanisms of complex biological processes has been the use of chemical inhibitors. With inhibitors sometimes individual steps of a reaction could be interferred with and the mechanisms of the overall reaction more fully understood. This approach has been especially useful in studies of the Hill reaction. The present work represents an extension of this approach, namely, the utilization of ultraviolet and gamma radiations as inhibitors in Hill reaction studies. These radiations were used as inhibitory agents under conditions that would permit a kinetic analysis of the results. Such an approach enables a comparative evaluation of the radiation effects on either or both of the subprocesses of the Hill reaction, i.e., the photochemical reaction or the enzymatic reaction. In addition to obtaining information about the Hill reaction mechanisms, the use of gamma radiations may provide additional information in radiobiological problems. A survey of the literature shows an absence of fundamental work on the effects of ionizing radiations on the photosynthesis mechanisms and of metabolism in higher plants. In view of possible increase of radioactive materials in our environment, we should have a better understanding of some of the fundamental radiobiological effects we can expect in plants and animals.

The general procedures for preparing the isolated plant chloroplasts and for making potentiometric measurements of the Hill reaction activity have been developed in this laboratory over several years by many different workers. In the present study the plants used for experimental material was rhubarb chard (Beta vulgaris L.). The leaves were ground in a mechanical blendor and the chloroplast fragments were separated by differential centrifugation. The Hill reaction rates were recorded electrically by using a calomel-platinum electrode couple which was fed into a Brown recorder. The kinetic treatment of the data follows the methods developed in this laboratory. The kinetic analysis permits a quantitative evaluation of the photochemical (k_L) activity and the enzymatic (k_D) activity of the overall reaction.

A low pressure germicidal lamp (2537 Å) was used for the radiation source in the ultraviolet irradiation studies. The gamma irradiation experiments utilized a Co^{60} facility of the U.S.A.F.-University of Texas, Balcones Research Laboratory, at Austin, Texas.

The experimental results can be discussed best under two headings as follows:

Ultraviolet Studies

The ultraviolet investigations showed that treatment of living plants with even small doses of irradiation resulted in several morphological changes. These changes included the rapid loss of the red anthocyanin pigment from the stems, an induction of chlorosis or loss of chlorophyll pigment which developed over several days, and the general tissue damage that leads to necrotic conditions or death of the tissue or plant. These changes could be modified by the post irradiation conditions of light and temperature under which the plant was placed. Recent interest in ultraviolet studies has resulted from the discovery of a reversal of the ultraviolet damage by visible light. Many attempts were made to demonstrate any photoreversal of the Hill activity inhibition but these experiments were without success.

It was shown that ultraviolet irradiation of a suspension of chloroplast fragments resulted in an inhibition of both the k_L and k_D activities with the photochemical rate constant (k_L) being the most sensitive to the ultraviolet damage. The use of yeast nucleic acid in the suspension during the irradiation provided some protection against the inhibitory effects of ultraviolet. The indirect damage by the formation of ozone may slightly affect the k_D values but does not greatly modify the values presented for direct ultraviolet inhibition.

Gamma Radiation Studies

It was found as a result of the gamma investigations that the sensitivity to damage by gamma irradiation varies with the age of the plant from which the chloroplast preparations were made. For example young plants would provide chloroplast fragments in which the Hill reaction activity could be inhibited 40 per cent with a dose of 50,000 roentgens of irradiation. Older more mature plants gave chloroplast preparations in which no inhibition could be demonstrated with doses as high as 300,000 roentgens. It was shown that in the sensitive material from young plants, the inhibition mostly affects the enzymatic, k_D, activity while the k_L is only slightly altered. This is in contrast to the ultraviolet irradiation studies in which the k_L rate constant was most sensitive. Chloroplast preparations irradiated at 4° C. showed a loss of chlorophyll from the irradiation but those irradiated at -36° C. did not.

Sensitive chloroplast material from young plants can

be partially protected against the damage of ionizing radiations by the potential sulfhydril compound, beta-aminoethylisothiuronium Br·HBr. The hydrobromide was shown to be three times as effective in its protective action as the hydrochloride salt of this compound. The presence of the Hill oxidant, potassium ferricyanide, during irradiation, was without any effect on the resultant inhibition.

Chloroplast material prepared from young plants also shows a sensitivity to increased oxidant concentration (in the range of 0.001 M. to 0.002 M. potassium ferricyanide). This sensitivity disappears as the plant becomes more mature.

The results were discussed with possible explanations regarding the decreasing sensitivity to ionizing radiations with an increasing age of the plant. One explanation suggests an unknown factor being supplied to the leaf tissue by the plant roots. In younger plants it was suggested that this factor was not as stable as in more mature plants. Another possible explanation suggests the accumulation of some metabolites in the more mature tissue which acted as protective agents. Other considerations must also be given to factors such as the rate of growth of the leaf tissue, size of the leaf, and perhaps many more factors, before these changes are understood.

116 pages. $2.00. Mic 57-1405

THE FEEDING AND NUTRITION OF CERTAIN HEMIPTERA AND HOMOPTERA

(Publication No. 20,260)

Carl Alfred Scheel Jr., Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor Stanley D. Beck

Problems concerned with the feeding behavior and nutritional requirements of plant feeding insects are of both biological and agricultural importance. Recent investigations have contributed significant information about the nutritional physiology of some mandibulate species, but research on the plant-sucking forms has awaited the development of laboratory techniques which provide the environmental and nutritional conditions necessary for prolonged feeding, growth, and maturation.

Previous workers have attempted to rear plant-sucking insects on liquid diets fed through membranes. The literature contains numerous reference to membrane feeding methods for leafhoppers, aphids, and coccids. However, none has proved successful for more than a short period.

During the early phases of the present study, attempts were made to feed several species of Hemiptera and Homoptera under modified conditions of most of the previously reported membrane techniques without success. Liquid diets fed through wick materials satisfied the feeding requirements of the squash bug, Anasa tristis (De. G.), for as long as two weeks, but no appreciable growth was observed. Means were not found for maintaining nutritionally adequate liquid diets in a condition acceptable to the insects.

The fact that certain Hemiptera feed on seeds and fruits led to the hypothesis that they might be reared on semi-solid diets. A technique was developed for feeding the milkweed bug, Oncopeltus fasciatus (Dal.), and a pentatomid, Euschistus variolarius (P. de B.). The feeding chambers used consisted of glass-covered pint ice cream cartons; glass-sleeved dental cotton wicks attached through the bottom of the cartons supplied water from jars upon which the cartons were seated. Diets were provided in pellet form or in shallow plastic dishes.

Oncopeltus has been reared from eclosion to imago on purified diets, but in most cases it was necessary to feed the nymphs on eggs of their own species or on milkweed seed during the first stadium in order to obtain subsequent growth and maturation. Glucose, sucrose, fructose, honey, and starch were utilized as energy source by this insect. Sodium caseinate was the most satisfactory protein used. Diets containing small amounts of corn oil resulted in better survival than did those containing large amounts. Diets containing pollen produced the best molting of first instar nymphs. Nymphs were attracted to diets containing starch and large amounts of yeast powder. Euschistus has been reared from second instar to adult on some of the diets found to be most satisfactory for Oncopeltus. This species does not feed during the first stadium. Development of both insects was slow on purified diets and adults produced were subnormal in size.

Oncopeltus was reared on six different kinds of nuts in a preliminary study of artificial diets. Black walnuts and blanched almonds produced good survival of adults which were somewhat smaller than those produced on milkweed seed. Survival on English walnuts, pecans, and blanched peanuts was poor and adults were approximately half the size of those reared on milkweed seed. Brazil nuts were insufficient to promote growth beyond the second instar. Euschistus has been tried only on blanched almonds. The first adults produced were normal sized and developed at a rate comparable to those reared on green beans, a natural food. 83 pages. $2.00. Mic 57-1406

POLITICAL SCIENCE, GENERAL

THE POLITICAL PARTIES AND POLITICS OF THE FOURTH REPUBLIC IN FRANCE: 1944-1948

(Publication No. 20,348)

Richard William Barron, Ph.D.
University of Virginia, 1956

The referendum of October 1946 gave France a constitution substantially the same as that of the Third Republic and from the fall of 1947 the politics and political institutions of the Fourth Republic began to function more and more in the manner of those of the pre-war regime.

Perhaps of all the French political systems, the Third Republic came to be the best adapted to French needs and to French character. Thus, such a development probably should not be surprising, especially in view of the force of tradition, precedent and custom on French political attitudes and in view of the conservative nature of French social structure.

However, the Fourth Republic at its inception evidenced many radical, revolutionary characteristics, some of which were unique in French political history. The inter-related facts of a system of a few highly disciplined parties and the domination of the legislature by the executive which characterized the parliamentary life and constitutional practice of the first years were distinct innovations.

The general election of October, 1945 produced an assembly quite unlike any of its predecessors. The three strictly disciplined, monolithic groups shared, in roughly equal numbers, nearly four-fifths of the seats. Upon the resignation of De Gaulle, a coalition government was formed by these three main parties (Communist - Socialist - M.R.P.) and a profound change in parliamentary practice became apparent. The fluid individualism which characterized parliamentary life in the Third Republic had been replaced by disciplined group action. This was true of the deputies in conservative opposition as well as those of "the big three" parties.

The assembly no longer possessed the dominant position, in relation to the government, that it enjoyed during most of the Third Republic. The executive was considerably stronger and more free, from a constitutional point of view, than before the war. Government policy was agreed to in the ministry and then in a sense "imposed" on the assembly through the means of party discipline.

On the whole, parliamentary practice with a new system of parties was not only unique but contained wholesome features which might have eliminated much of the ministerial instability and executive weakness that so seriously troubled the Third Republic. The strong tendency to return from the revolutionary to the traditional way of things in less than three years may be viewed as somewhat unfortunate. Either the climate of popular sentiment necessary to support radical change never existed or if it did exist it was dissolved quickly by the force of realities and events at home and abroad.

The purpose of this study was to analyze the singular aspects of French government and politics in the "revolutionary" years immediately following the Liberation. This involved especial attention to the party system in general and to the doctrine, program, organization, clientelle and campaign techniques of each of the parties in particular. It also involved an estimation of the basic post-war political issues that have established the temper of French politics since the revolution of 1789.

The basic research was accomplished in France during the year of 1947. Documentary material included the statutes, documents and written propaganda of each of the various parties, newspapers and periodicals, and official government publications such as the Journal Officiel and the reports of various legislative committees.

A considerable use was made of personal interviews, conversations with party leaders, members of the National Assembly and Cabinet Ministers. Frequent consultations were held with French scholars such as Andre Siegfried and Francois Goguel, and with certain English scholars such as D. W. Brogan, David Thomson and the late Harold Laski. The entire study was written and organized with the advice and overall supervision of the distinguished American student of French affairs, Professor R. K. Gooch. 454 pages. $5.80. Mic 57-1407

CONDITIONS FOR FEDERATION

(Publication No. 18,688)

Chien-kuen Kiang, Ph.D.
The University of Nebraska, 1956

Adviser: Norman L. Hill

This study is in attempt to answer the question: under what conditions can a federation be set up? Its purpose is to get a better understanding of the background of modern federations and at the same time to throw some light on the possibility of realizing recent projects for world, regional, or ideological federation.

In order to avoid duplication and to make use of earlier thinking on the subject, research was first made into the opinions of a number of modern authors. The research disclosed a large number of hypotheses which set forth conditions for federation. These hypotheses were then subjected to careful examination based upon the experiences of the fourteen federations now in existence--the United States, Mexico, Venezuela, Switzerland, Argentina, Canada, Germany, Brazil, Australia, South Africa, Soviet Union, Yugoslavia, Burma, and India. The examination included as many important aspects of the subject as possible, such as the size of a country, geographical contiguity, isolation, strength of the participating units, their earlier relationships, previous experience, trasitional arrangements, language, religion, ethnic background,

nationality, economic interests, social systems, governmental concepts, education, external pressure, foreign example, psychological forces, war, revolution, leadership, etc. This examination constituted the main body of the thesis.

The result of the examination indicates that most of the earlier hypotheses must be rejected. The study disclosed that in the fourteen federations the following conditions had always been present: (1) A geographical contiguity of the participating units; (2) An earlier subjection of the participating units to a common authority; and (3) Similar governmental concepts of the participating units. The following conditions had been present frequently but not always: (1) A transitional arrangement of some kind by the participating units before federation, such as confederation or even a temporary unity; (2) Earlier existence on the part of the participating units as distinct governmental entities; (3) Foreign example as a stimulus; and(4) Common economic interests. Other conditions which had been present occasionally or in a certain emergent situation are: (1) Influence of the mother country; (2) Revolution; (3) Effect of war; (4) Propaganda; and (5) Statesmanship or leadership.

In applying the findings of the study to recent projects for world, regional, or ideological federation, it seems that the conditions favorable to the projected federations, in most cases, have not been adequately present.

230 pages. $3.00. Mic 57-1408

THE POLITICS OF LOYALTY, FROM LA FOLLETTE TO McCARTHY IN WISCONSIN: 1918-1952

(Publication No. 20,139)

Karl Ernest Meyer, Ph.D.
Princeton University, 1956

Few politicians in American history have excited as much controversy as Senator Joseph R. McCarthy of Wisconsin. One puzzling aspect of his career is the fact that McCarthy, a champion of the far right, emerged from a state long identified with liberalism. How did it come about? Is there any continuity between McCarthy's movement and the earlier Wisconsin Progressive movement founded by Senator Robert M. La Follette, Sr.?

In order to explore the roots of McCarthy's appeal in Wisconsin, a survey was made of state voting returns and census data over a fifty-year period. Interviews were conducted with leading political figures, and manuscript collections and contemporary newspaper accounts were studied with the aim of finding clues to Wisconsin's shift from La Follette to McCarthy.

On the basis of this data, three major conclusions are drawn:

1. Wisconsin's liberalism was exagerrated in the past. The elder La Follette's greatest electoral victories came after World War I, when he gained the support of many traditionally conservative German-American voters as a result of his opposition to World War I. Thus, much of his support had little to do with liberalism, but instead represented approval of his vigorous anti-interventionist attitude.

2. Important points of continuity can be found between the appeals of La Follette and McCarthy. In terms of tactics, both Wisconsin Senators conveyed a similar image of embattled insurgency. Further, both Senators exploited existing resentment to interventionist foreign policy. Finally, county voting returns show a continuity in support between the isolationist wing of the La Follette movement and the strongest pro-McCarthy counties in 1952.

3. Equally striking, however, are the contrasts between the two Wisconsin Senators. McCarthy acquired money, respectability and publicity from Wisconsin groups that were traditionally hostile to the La Follette Progressives. Unlike La Follette, McCarthy offered no comprehensive program of economic and political reform. In terms of personal qualities, the elder La Follette's integrity and devotion to democratic ideals were widely respected; McCarthy's career has not given evidence of either quality.

If the similarities between the two Senators help explain McCarthy's success in Wisconsin, their differences illumine the limitations of McCarthy's appeal. Even in 1952, under the most favorable circumstances, McCarthy's electoral showing in Wisconsin failed to match his reputation for omnipotence. Events since 1952--particularly the easing of world tensions and falling farm income in Wisconsin--have further underscored McCarthy's limitations. If Wisconsin's liberalism was exagerrated in the past, the evidence suggests that McCarthy's hold on Wisconsin has been overly-magnified in the present.

276 pages. $3.55. Mic 57-1409

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

PORTRAIT IN ISOLATIONISM: THE LA FOLLETTES AND FOREIGN POLICY

(Publication No. 20,246)

Alan Edmond Kent, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor James L. McCamy

That the stand of the La Follettes (Robert M., Sr. and Jr.) in regard to the two world wars was applauded by a large section of the German-American element in Wisconsin could scarcely be denied. That the senators, the father particularly, the son with less guile, exploited the German-American resentment toward World War I, based as it was on a reaction to a home-front hysteria as well as to a conflict which pitted American soldiers against the troops of the fatherland, also seems reasonably plain.

Nonetheless, La Follette isolationism was essentially a protest in the tradition of progressive liberalism. Robert M. La Follette, Sr., opposed a declaration of war in 1917 not so much because of a German-American constituency, but because he felt that war spelled a farewell to reform. In addition, he believed that modern wars settled none of the fundamental questions at issue and served only to promote the doctrine of imperialism and sow the seeds of future conflicts.

"Old Bob's" remedy? Stay away from war, from foreign entanglements with imperialist powers, from international organizations which sought to preserve an unjust status quo. By 1946, however, Bob, Jr., had begun to take another approach. Wars could not be prevented simply by ignoring them. If economic progress were to be achieved in the United States, a world at peace was an important prerequisite. Wars have to be prevented and to achieve this end, the nation must join international organizations, should promote a united Europe, should utilize its considerable power and prestige to make its point of view prevail in world councils and should assist war-torn nations in economic rehabilitation. Bob, Jr., injected a number of "ifs" and "buts," and sought constructively to suggest improvements in what he considered to be an inadequate international organization. But the shift in orientation from the viewpoint of the elder La Follette was clear. Unlike the father, the son did not appear as an "irreconcilable." He would compromise certain of the La Follette tenets on foreign affairs, roughly that the nation could not work with powers who still clung to the vestiges of imperialism, promoted an unjust status quo and did not erase the fundamental causes of war, in hopes that an active U. S. foreign policy might achieve what a passive approach could never accomplish; namely, the acceptance by all nations of the world of a progressive (La Follette) program of foreign and domestic reform.

The La Follette tradition of dissent in foreign affairs, despite all its anxious gropings for gossamer objectives impossible of immediate fulfillment, was not cynical or carping or reactionary, but rather straightforward, idealistic, embued with concern for the world's less fortunate. For throughout the La Follette approach to foreign policy appears this core of humanitarianism which hates war, not so much because of any pacifist orientation, though this would appear stronger in "Old Bob's" record than that of his sons, but because of the threat war holds for reform, be it labeled a "New Freedom" or a "New Deal."

That humanitarian thread found the La Follettes arrayed against imperialism, cartels, dictatorship, Fascism, Communism and the cynical machinations of power politics. Their insistence on economic justice and individual freedom made them champion the principle of self determination, rendered them eager to urge a pacific ending of the domination of subject peoples by colonial powers.

The La Follettes, Bob and Bob, Jr., were not alone in etching the portrait of Wisconsin isolationism for the period, 1917-1946. The records of other Wisconsin congressmen, representing a variety of parties and factions, have been utilized to present a more well-rounded study.

497 pages. $6.35. Mic 57-1410

THE IMPACT OF THE PETROLEUM INDUSTRY ON IRAQ AND BAHRAIN

(Publication No. 20,644)

Fahim Issa Qubain, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Llewellyn E. Pfankuchen

Objective: The objective of this study is to assess the impact of the petroleum industry on the economic, social and political institutions of Iraq and Bahrain, and to describe the ways in which oil revenues have been used to develop the resources of the above-mentioned two countries and raise the living standards of their peoples.

Sources. The study is based mainly on field research carried on in 1952-53 and on primary publications and reports. These are supplemented by secondary sources such as books, periodical literature, magazines and newspaper accounts.

Procedure. The work is divided into two main parts: the first deals with Iraq and comprises nine chapters (I-IX). The first chapter gives a brief description of conditions in Iraq as they existed in 1920-21. Chapter II deals with the social structure and social conditions in the country up to 1950. Chapters III-V deal respectively with the evolution of the petroleum industry, its relations with the government and the people, and with labor conditions in the industry. Chapter VI discusses the development of Iraq from 1920 to 1950 and the part the oil industry played in this development. Chapter VII assumes a new era and describes the administrative structure of the Development Board and outlines its major plans and programs. Chapter VIII discusses in considerable detail the extent to which the Development Board and other government agencies have succeeded or failed in carrying out the mandate entrusted to them. Chapter IX makes conclusions about the contribution of the oil industry to Iraq and postulates possible future developments.

The second part composed of seven chapters (X-XVI) deals with Bahrain and follows essentially the same procedure as in the case of Iraq.

Results. The petroleum industries of both Iraq and Bahrain began both as business ventures and as instruments of national policy. During their early stages of formation, an extended diplomatic battle took place between the American and British governments which culminated in allowing American capital to participate in the exploitation of the oil fields of the Middle East. Since then, American capital has penetrated gradually until today it is major in the area.

With the growth of native national movements and the corresponding political decline of Europe, there has been, especially lately, a marked tendency on the part of the oil industries of Iraq and Bahrain to de-emphasize their national origin and to identify themselves with the local governments and their peoples. This is especially true in the case of Iraq.

In the case of Iraq from 1927 to 1950, the petroleum industry played a relatively minor role in the life of the country. Both production and royalties were low. After the introduction of the fifty-fifty profit-sharing formula in 1951, the oil industry became the central factor influencing economic, social, and (indirectly) political life. By 1955, oil revenue began to account for over one-third of the total national income. Seventy percent of this income is now being used to develop the natural and human resources of the country. It has been conservatively estimated that by the early sixties the standard of living will be doubled.

In the case of Bahrain, because of the smallness of the country, the impact is more evident but less positive. The economy of the country is to all practical purposes dependent on oil. Unlike Iraq, Bahrain has no natural resources other than oil and manpower which can be developed. Politically, the industry is gradually making the smooth functioning of the regime in Bahrain and the Persian Gulf

difficult. Socially, it is destroying well-tried institutions and beliefs and replacing them or super-imposing on them new ones which are not, in some cases, in harmony with the genius of the native population.

414 pages. $5.30. Mic 57-1411

PSYCHOLOGY

PSYCHOLOGY, GENERAL

CONFIGURAL SCORING AND PREDICTION

(Publication No. 20,365)

Edward Franklin Alf Jr., Ph.D.
University of Washington, 1956

Clinical psychologists have maintained that valuable information could be gained by considering not merely an individual's total score on a test, but by considering the patterning of the individual item responses. Although statisticians have recognized the validity of this contention, they have been reluctant to come to grips with the problem because of the tremendous computational difficulties involved. When there are t dichotomous items, there will be 2^t possible patterns of response. Thus for as few as ten items there will be 1,024 possible patterns of response to consider.

It is shown that an individual's pattern on a set of dichotomous items can be represented by a polynomial function, considering each possible cross product of items as a term in the function. It is demonstrated that the polynomial function representing an answer pattern can be represented as a row vector. It is then possible to arrange the vectors representing the possible answer patterns in the form of a triangular matrix. It is shown that if only n of the possible 2^t answer patterns occur, then certain rows and columns of the original triangular matrix can be deleted, making an n by n triangular matrix. This n by n triangular matrix is called the configural data indicator matrix.

Each row of the configural data indicator matrix represents a distinct answer pattern, and each column represents an item cross product term. It is possible to weight the columns of the configural data indicator matrix so that for each pattern the function will have as its value the mean criterion value for all persons having that pattern. It is thus possible to determine a scoring formula which has maximum validity in the least square sense.

A method for quickly determining the multiple correlation between the configural variables and a criterion is presented. Although the multiple correlation between the variables in the configural data indicator matrix and any criterion will be a maximum for the sample upon which the weights were calculated, it may not be as high when applied to a new sample. A method for correcting for shrinkage in the multiple correlation is discussed.

A method for comparing the multiple correlation between the variables in the configural data indicator matrix and the criterion with some conventional correlation coefficient is discussed. In this way it is possible to tell if configurally scoring the set of items will significantly improve our ability to predict a criterion.

A method for selecting a sub-set of predictors from the configural data indicator matrix is discussed. A subset of configural variables may do a better job of predicting a criterion on successive samples.

Scoring formulae are developed on a data sample using configural scoring techniques developed in the thesis and using also traditional multiple correlation technique. The scoring formulae are applied to a new sample, and the correlations between the predictions and the actual criterion values are calculated for all three scoring formulae. In the example used, configural scoring does not result in better prediction of the criterion than can be obtained by traditional multiple correlation techniques. In this example there would be no advantage in using configural scoring techniques.

Computational procedures are given for scoring a set of items configurally, and for determining when configural scoring is advisable. 76 pages. $2.00. Mic 57-1412

AN ANALYTICAL AND EMPIRICAL EXAMINATION OF SOME PROPERTIES OF IPSATIVE MEASURES

(Publication No. 20,373)

William Vance Clemans, Ph.D.
University of Washington, 1956

The properties of ipsative measures, a term coined by Cattell, are examined from an analytical and empirical point of view.

A set of attribute measures is defined as ipsative when the sum of scores over all attributes for each entity is constant. Three sets of ipsative scores were calculated from fictitious sets of primary data. Several observations, such as the necessity for standardizing variables prior to ipsatizing, were made on these data. The properties of ipsative variables determined in the mathematical section were tried out on data obtained from the entrance test scores and college grades of 129 students who entered the University of Washington in the Fall of 1953.

It was determined that: (1) an ipsative intercorrelation matrix can be expressed as a simple function of the matrix of intercorrelations for the same variables prior to ipsatizing; (2) the sums of the columns (or rows) of an ipsative covariance matrix must always equal zero; (3) in the special case where the ipsative variances are equal, the sums of the columns (or rows) of the ipsative intercorrelation matrix are equal to zero; (4) ipsative intercorrelation

matrices are non-basic and thus have no regular inverse; (5) the validity coefficients for an ipsative set of variables can be expressed as a function of the intercorrelation matrix and vector of validity coefficients for the same variables prior to ipsatizing; (6) the sum of the covariance terms obtained between a specified criterion and a set of ipsative variables is zero; (7) in the case where the ipsative variances are all equal the sum of the ipsative validity coefficients is zero; (8) the multiple correlation of a set of ipsative variables with a criterion can be expressed as a function of the multiple correlation for the pre-ipsatized variables and their β-coefficients; (9) the least square estimate of a criterion using all of the variables of an ipsative set is identical with the least square solution with any single variable deleted; (10) the loss of ability to predict a criterion occasioned by the deletion of a variable from a raw set can be expressed as a function of the corresponding β-coefficient and the corresponding diagonal element of the original inverse; (11) when the variables in non-ipsative form are orthogonal, the ipsative intercorrelations will all be a negative constant value determined by the number of variables; (12) when the variables in non-ipsative form are all correlated with each other to some constant degree, a, the ipsative intercorrelations will be exactly the same as if the original variables had been orthogonal; (13) when the column sums of the pre-ipsative intercorrelation matrix are all equal and the off-diagonal correlations are distributed normally, the proportion of negative values in the ipsative intercorrelation matrix can be determined from the normal curve; (14) when the original scores are in normalized units and the sums of the columns of the original intercorrelation matrix are all equal, then the ipsative covariance matrix and the first centroid residual are identical; (15) under certain circumstances it can be shown that the information loss occasioned by removing the first centroid is equivalent to that lost by transforming the original scores to ipsative units; (16) under a very special restriction a set of ipsative variables will correlate perfectly with their absolute counterparts; (17) if the column means of the pre-ipsative matrix are equal, the column means of the resulting ipsative matrix must be equal; (18) if the variances but not the means were equated prior to ipsatizing, transforming the resulting ipsative scores to deviation units will yield interpretable results; and (19) if the variances were not equated prior to ipsatizing, normalizing after ipsatizing will not make the resulting scores meaningful.

100 pages. $2.00. Mic 57-1413

LONG-RANGE PREDICTION OF OFFICER ACHIEVEMENT IN THE UNITED STATES AIR FORCE

(Publication No. 20,751)

Frank Bernard Ford, Ph.D.
Washington University, 1956

Chairman: Dr. P. H. DuBois

This study is an investigation of the relationship between a battery of standardized tests and two "global" measures of success for officers in the United States Air Force. A six-year time lapse existed between time of testing and time of criteria measurements.

A sample of 756 cases who were tested on the Air Force Aviation Cadet battery during 1943 were found to be on active duty in 1949. Their officer rank and their officer efficiency rating were collated with the earlier testing. A similar sample of 296 cases was reserved for cross-validation purposes.

The set of 756 cases was utilized to produce a regression equation for each criterion. These equations were then used to compute a predicted rank and a predicted officer efficiency rating in the sample of 296.

The predictive efficiency of the equations was evaluated, and the following conclusions were supported:

1. Scores on the Rating of Officer Efficiency are so highly intercorrelated that any one may represent any other insofar as predictable variance is concerned.

2. Rank has such a low variance, among persons entering the service at the same time, that its value as a criterion is limited.

3. The size of the multiple correlations (about +.2 for both criteria), although small, are surprisingly large in view of the amount of attenuation due to unreliability in the criteria and in view of the restriction of range that was operative.

If the regression equations had been maximizing chance deviations alone, the cross-validation correlation (between predicted and actual scores in a new sample) would have fallen to zero rather than only to .12. That it is not zero indicates that a small amount of true variance is being accounted for.

The fact that the span of time (six years) between testing and criteria was more than sufficient for significant changes to take place in the subjects adds support to the view that the attainment of any significant correlation at all should be considered very promising for future research concerned with long range prediction of achievement.

4. The sample on which the computations were made is, in most cases, a practical representation of the graduates from training even though the critical ratios are significantly different from zero.

5. Concerning the types of variables which stand out in their relevance to the criteria, the generalization is that scoring keys and tests designed around success in pilot training are negatively related to the criteria. Tests and keys directed toward prediction of success in navigator training, and to a lesser extent bombardier training, are positively related to the criteria.

If these findings are borne out by additional research, it would seem to indicate a revision in our approach to the peace-time selection of Air Force Officers. Many factors determine the success or lack of success of an officer's career. The indication here would seem to be, however, that the great emphasis placed on pilot skills in the selection of potential career officers is a mistake. These skills seem to be negatively related to "success" as an officer in later years. They may be a necessary condition, but they do not seem to be an entirely sufficient one.

98 pages. $2.00. Mic 57-1423

AN INVESTIGATION OF EIDETIC IMAGERY IN CONDITIONS OF HYPOCALCEMIA, WITH AND WITHOUT LATENT TETANY

(Publication No. 20,286)

George Gershon Katz, Ph.D.
New York University, 1956

A study was made to determine whether a physiological type of eidetic imagery existed in states of hypocalcemia with latent tetany and in conditions of hypocalcemia in the absence of latent tetany.

This investigation was an outgrowth of the research conducted by the Marburg school. More specifically, it was a validation study of Erich Jaensch's Tetany type concept as it applies to the phenomena of after-imagery and eidetic imagery.

The subjects were in-patients of Bellevue Hospital and New York Hospital. Comprising Group #1 were 23 individuals with low serum calcium, in the absence of neural hyperexcitability. In 21 of these cases, the blood calcium imbalance was associated with some form of kidney dysfunction. The two other cases suffered from gastrointestinal disturbances.

Group #2 consisted of 8 patients exhibiting the hypocalcemiatetany complex. These patients all manifested post-operative hypoparathyroidism.

The blood chemistry analyses were done by the laboratories of the respective hospitals. The Chvostek test, used to check for latent tetany, was administered by the medical staff. The visual examination, conducted by the investigator, was designed in terms of the techniques outlined by previous experimenters.

In the discussion of the pertinent physical-chemical aspects involved in this study, it was noted that an ionic calcium imbalance was believed to be the crucial factor explaining the appearance of hypocalcemic tetany.

An analysis of the visual test results showed that Group #2 subjects were more susceptible to excitation by the complex stimuli. Image duration was also found to be a salient characteristic distinguishing the visual experiences of Group #1 and #2. The factors of clarity, number of details and color of the phenomenon did not, in themselves, adequately discriminate degrees of imagery disposition.

Group #2 subjects underwent medical treatment to alleviate the adverse blood calcium condition. It was thought that the therapy might have the additional effect of diminishing the extent of the visual imagery. These patients were given, therefore, another imagery test following therapy. The findings were statistically inconclusive. However, it was noted that where latent tetany had been significantly reduced, the imagery disposition had also been decreased.

In comparing the visual test results of other studies with those yielded by Group #2, it was felt that the phenomena experienced by the latter could not properly be called eidetic. The response characteristics were much more in keeping with after-imagery. However, the manifest qualities of this imagery seemed to be consistent with those attributed to the Tetany type phenomena of Jaensch. Expressed in another way, it may be said that Group #2 evidenced enhanced after-imagery. The investigator considers this designation less ambiguous than -T type imagery, although both terms apparently refer to the same kind of visual experience. 104 pages. $2.00. Mic 57-1414

INDIVIDUAL CONFORMITY TO A GROUP PRODUCED STANDARD AS A FUNCTION OF GROUP SIZE AND LENGTH OF MEMBERSHIP CONTACT

(Publication No. 19,000)

Jerry Stuart Kidd, Ph.D.
Northwestern University, 1956

Supervisor: Donald J. Lewis

The present experiment attempted to test hypotheses in three interrelated areas; situational variables and group conformity, personality variables and group conformity, and group problem solving.

The major predictions with regard to situational variables and conformity were as follows: conformity would increase as group size increased from two, through four, to six members; conformity would increase as length of group contact increased from one hour, through two hours, to three hours of contact; and, that there would be a significant interaction between the variables of group size and length of contact.

These predictions were tested by utilizing a three by three factorial design. No significant relationships were obtained between the experimental variables and conformity by either analysis of variance or covariance. There was no significant interaction.

Subsidiary experimental hypotheses were tested by obtaining data from two conditions appended to the main three by three design. The first of these additional conditions allowed for a partial extension of the length of contact dimension by providing a situation in which group contact was from one to four minutes only. An analysis of variance on the data obtained from the four conditions of length of contact; namely, one to four minutes, one hour, two hours, and three hours of contact; was performed and the F ratio obtained was not significant. By employing an artifice in the form of the remaining control condition, a further test of the dimension of length of contact was possible. An analysis of variance comparing the conformity results from the three conditions; no contact, one to four minutes of contact, and three hours of contact; was done and a significant F ratio was obtained. This finding was interpreted as indicating that the length of contact dimension is essentially dichotomous.

The second subsidiary experimental hypothesis predicted that conformity would be greater if the source of the standard or norm was a specific group in which the S was a member as opposed to a situation in which the standard or norm had a source which was vaguely specified or anonymous. This prediction was tested by a t test between the mean conformity score of Ss in the control condition in which the source of the standard was anonymous and the mean conformity score of the pooled conditions in which the standard's source was fellow group members. The t ratio was significant between the two means and the finding was interpreted as indicating that the source of the standard or norm is an effective variable in conformity.

The personality dimensions investigated were "anxiety" and "subjective orientation." No significant relationship was observed between "anxiety" and conformity. A significant correlation, however, was found between "subjective orientation" and conformity. The most discriminative items in the "Subjective Orientation" scale were items that reflect a conservative adherence to common religious

teachings. The significant correlation was interpreted as indicating that the conformity response is modified by Ss' attitudes and characteristics in interaction with situational variables and group characteristics.

Efficiency in problem solving as a function of group size was examined from two points of view. The first point of view regarded the group as the producing unit. From the results obtained by having individuals alone and two, four and six member groups solve a jumbled sentence task, it was observed that there was no significant increment in efficiency as group size increased. This observation was tested by analysis of variance. The F ratio was not significant indicating no difference between individuals and the various sized groups.

The second point of view regarded the individual as the producing unit. In this case, it was observed that individual productivity declined as the number of coworkers increased. This result was tested by analyses of variance between zero co-workers, one co-worker, three co-workers, and five co-workers using data from the jumbled sentence task and a jig saw puzzle task in separate analyses. The F ratios from both analyses indicated a significant decrement in efficiency as number of co-workers increased. The results were found to be congruent with recent observations on the same question. 90 pages. $2.00. Mic 57-1415

VOCATIONAL CHOICE AND PERSONALITY: A STUDY OF THE RELATIONSHIP OF PERSONALITY TO CHOICE OF VOCATIONAL FIELD AND VOCATIONAL ASPIRATION LEVEL

(Publication No. 20,006)

Walter L. Tanzer, Ph.D.
New York University, 1956

The Problem

The purpose of the investigation was to study the relationship between personality and vocational choice. The specific problems were:

1) To what extent are personality traits related to vocational aspiration level?

2) To what extent are personality traits related to choice of occupational field?

Procedure

The vocational choices of a group of one hundred eighty-three young, male, non-disabled, Korean veterans were ascertained. These choices were then classified according to their level on an occupational hierachy scale and, also, according to their occupational field. Occupational field was judged with respect to the major characteristic activity of the vocation selected, either Materials and Symbols Handling, Personal Contact-Business or Personal Contact-Service. The Guilford-Zimmerman Temperament Survey was administered to all the subjects, and, with minor exceptions, scores on the Otis Test of Mental Ability, the Bennett Test of Mechanical Comprehension, the Minnesota Clerical Test, Minnesota Paper Form Board, and the Lee-Thorpe Interest Inventory were obtained as well as information as to father's occupation.

Means and Standard Deviations of test scores were obtained for the total population and each vocational level and field and single cell of the vocational classification.

The vocational classification was condensed to a 3X3 table and analysis of variance methods were applied. The F-test was utilized to determine whether the differences between sub-groups were significant.

The vocational classification was further condensed to a 2X2 table and analysis of variance with attendant F-tests applied.

The chi-square test was applied to the data relative to field of interest and father's occupation to determine whether the differences from the expected number in the sub-groups were significant.

Results

Virtually the entire population chose occupations in the upper half of the occupational hierachy scale. One hundred and six men chose occupations in the Materials and Symbols Handling Field, fifty-four chose Personal Contact-Business and twenty-three chose Personal Contact-Service. Choices were almost equally divided between professional level and non-professional occupations.

Temperament trait scores closely approximated those of the norm population.

Mental ability test scores indicated that the population was select.

Veterans choosing the Personal Contact fields had significantly higher mean scores on the traits of Ascendance and Sociability than clients choosing the Materials and Symbols Handling field. Personal Contact-Business persons had higher means than Personal-Service. Veterans choosing occupations at the lowest Materials and Symbols level had a significantly lower average score in Sociability, and the lowest Personal Business category had the highest average score.

The traits of Thoughtfulness, Restraint and Friendliness were significantly and positively related to level of vocational choice.

Mental ability, clerical aptitude and ability to perceive spatial relations were significantly and positively related to level of vocational choice. Persons who chose the professional level Materials and Symbols category averaged substantially higher on the test of mechanical comprehension than the rest of the population.

Interest level and father's occupational level were significantly and positively related to level of choice.

130 pages. $2.00. Mic 57-1416

AN INVESTIGATION OF SOME EFFECTS OF THE PRETEST ON THE MEASUREMENT OF ATTITUDE CHANGE

(Publication No. 19,882)

Peter Vytautas Vygantas, Ph.D.
University of Illinois, 1956

The purpose of this investigation was two-fold: (a) to determine the effects of the pretest, the experimental condition, and the interaction between the pretest and the experimental condition upon the attitude position of the subjects and their intra-individual variability; and (b) to

explore whether items of an attitude scale, as a group, remain relatively consistent over two applications of the scale, with or without an intervening experimental condition.

An extended experimental design with one experimental and three control groups was used. The experimental group was subjected to the pretest, the experimental condition and the posttest; the first control group, to the pretest and posttest; the second control group, to the experimental condition and the posttest; and the third control group, to the posttest only. The experimental condition consisted in the submission of a set of statements concerning "Our Immigration Restrictions" to the experimental group. The statements were attributed to a fictitious organization. The experimental condition was applied about three weeks after the pretest, and the posttest followed immediately after the experimental condition. Disposition toward unrestricted immigration into the United States was selected as the attitude. A Thurstone equal-appearing-interval scale was developed and used as the measuring instrument. The information to the subjects was presented in the form of a printed message, Three hundred and eighty-four students served as subjects.

The findings of the study indicated:

(1) The information submitted to subjects in the form of a printed message was effective in changing the attitude of the subjects.

(2) The interaction effect between the pretest and the subsequent experimental condition did not have significant effects upon the attitude position of the subjects and their intra-individual variability.

(3) The pretest affected intra-individual variability on the second application of the attitude scale without the intervening experimental condition. A decrease in variability was demonstrated. Although a definite trend of increase in individual variability of responses was indicated, the experimental condition did not show a significant effect upon intra-individual variability.

(4) Items of an equal-appearing-interval scale remain relatively consistent over two applications of the same test either with or without the intervening experimental condition.

(5) Failure to demonstrate significant effects of interaction between the pretest and the subsequent experimental condition decreases the validity of the scepticism raised with regard to the dependability of interpretations of previous attitude studies.

(6) The findings with regard to the effect of the pretest upon individual variability support speculations with regard to 'sensitization' and 'inconsistency' as attitude reaction tendencies.

(7) The superiority of the extended experimental design has been demonstrated. 175 pages. $2.30. Mic 57-1417

VALIDATION OF THE SELECTIVE SERVICE COLLEGE QUALIFICATION TEST AND RELATIONSHIPS WITH CERTAIN NON-COGNITIVE VARIABLES

(Publication No. 19,442)

William Hamlin Ward, Ph.D.
Purdue University, 1956

Major Professor: H. H. Remmers

The primary purpose of this study was to investigate the predictive validity of the SSCQT at Purdue University. The criterion employed was first semester grade point index. In addition an attempt was made to identify non-cognitive variables which would improve the predictive efficiency of the test.

The total SSCQT score correlated .573 with the criterion. It was found to be reasonably valid as a predictor of grades in English, mathematics, and chemistry courses.

The test performance of students in various schools of the university was investigated by means of an analysis of variance procedure and highly significant differences were found. Freshmen scored significantly lower than students in more advanced classes but 18 year olds tended to be superior to students over 18.

No significant non-cognitive variables were uncovered which add to the predictive efficiency of the test. An improved method for the identification of overachievers and underachievers is offered for use in future research or counseling.

It is concluded that SSCQT is a valid and reliable instrument for predicting grades in a predominantly engineering university. 79 pages. $2.00. Mic 57-1418

A STUDY OF SCHOOL DESEGREGATION: ATTITUDE CHANGE AND SCALE VALIDATION

(Publication No. 20,501)

Paul Gordon Whitmore, Jr., Ph.D.
The University of Tennessee, 1956

Major Professor: E. Ohmer Milton

A scale of attitude toward the Negro constructed by W. L. Williams, Jr. by the Guttman technique and composed of items having behavioral referents was administered to the eighth grades at two junior high schools and the tenth and twelfth grades at a senior high school. Although all three schools had desegregated five months prior to the administration of the scale, one of the junior high schools did not have any Negro students in attendance.

Williams had administered the same scale to the eighth grade students at the two junior high schools and the tenth, eleventh, and twelfth grade students at the senior high school in the previous spring before desegregation occurred. Comparing the two eighth grade and the tenth grade students with corresponding groups from Williams' study demonstrated that the students tested after desegregation occurred had significantly lower scale scores than those tested before desegregation occurred. This finding held up in all three schools including the junior high school

that had no Negroes in attendance even after desegregation occurred. Nor were any over-all sex differences found.

Analysis of pre- and post- desegregation scores of 195 twelfth grade students demonstrated that direction of attitude change per se was not related to opportunity for intergroup classroom contact, sex, intelligence, vocational status of father, or initial attitude. It was suggested that the fact of desegregation had stimulated behavioral expressions of attitude and that it was the increased expression of attitude rather than intergroup contact that had been instrumental in effecting the decrease in scale scores.

Two approaches to the problem of validation were utilized. The first approach consisted of the construction of a scale by a modified Guttman technique in which the items referred to the past occurrence of behaviors involving Negroes. Using this scale as the criterion measure, it was found that the relationship between the criterion scale and the first administration of Williams' Scale as subjects having no or little intergroup classroom contact were deleted from the analysis.

The second approach utilized two groups of subjects drawn from each extreme of the distribution of the first administration of Williams' Scale. These subjects were introduced into an experimental situation in which they responded silently to a series of ambiguous stimuli in the presence of a Negro and white confederate who responded aloud. A significant mean difference between the two groups was obtained with the pro- Negro subjects agreeing more with the Negro confederate than did the anti- Negro subjects, but the association between attitude and responses in this situation was not significant.

71 pages. $2.00. Mic 57-1419

PSYCHOLOGY, CLINICAL

THE RELATIONSHIP OF MATERNAL ATTITUDES TO THE DIAGNOSTIC CATEGORY OF THE CHILD: A DESCRIPTIVE STUDY OF MATERNAL ATTITUDES TOWARD CHILD BEHAVIOR, AND THEIR RELATIONSHIP TO THE KIND OF ADJUSTMENT MADE BY THE CHILD, AS SEEN IN THE QUEENS COLLEGE EDUCATIONAL CLINIC DURING ONE YEAR

(Publication No. 20,269)

Alice E. Abbe, Ph.D.
New York University, 1956

The Problem

Literature dealing with child development and recent studies in attitudes have emphasized a relationship between parental standards and child behavior.

The purpose of this study is to test the hypotheses that: (1) the mothers whose children are diagnosed as suffering from an emotional disorder will show a higher incidence of restrictive and lax and overindulgent attitudes than the mothers of children who have been diagnosed as making a normal adjustment; (2) the mothers of children diagnosed as neurotic will reveal a higher incidence of restrictive attitudes than mothers whose children are otherwise classified; (3) mothers whose children are diagnosed in the category of primary behavior disorder will show a higher incidence of lax and overindulgent attitudes than the mothers of children otherwise classified.

Design of the Study

In this study two groups of subjects were involved. The first was a group of eighteen mothers whose children were diagnosed as making a normal adjustment. The second was a group of sixty-six mothers whose children were diagnosed as disturbed.

The maternal attitudes were categorized on the basis of scores on an attitude survey and attitudes expressed during the intake interview. The mothers were classified as restrictive, lax and overindulgent, inconsistent, or moderate.

The children were categorized on the basis of a complete clinic study, using those tests and devices which are commonly used for this purpose in child guidance clinics. Classifications for the disturbed group were neurosis, primary behavior disorder, and simple maladjustment.

The distribution of maternal attitude categories in the normal group of children and in the several diagnostic sub-groups of the disturbed group of children was tallied and tabulated.

In the disturbed group, a statistically significant general relationship between the mothers' and children's classifications was tested by the Chi Square method. Critical ratios were obtained and tabulated in a search for specific relationships. Five case histories were included to highlight additional qualitative factors which represented important considerations for interpreting the data and in arriving at conclusions.

Conclusions

Evidence from the statistics and the case histories point to the importance of maternal attitudes as one factor related to the adjustment of the child.

The hypothesis that the mothers whose children are diagnosed as suffering from an emotional disorder would show a higher incidence of restrictive and lax and overindulgent attitudes than the mothers of children who have been diagnosed as making a normal adjustment was supported.

The hypothesis that the mothers of children diagnosed as neurotic would reveal a higher incidence of restrictive attitudes than the mothers whose children are otherwise classified was not supported.

The hypothesis that the mothers whose children were diagnosed in the category of primary behavior disorder would show a higher incidence of lax and overindulgent attitudes than the mothers of children otherwise classified was not supported.

Implications

The study reinforces the theory that in treatment centers the mother should be involved as well as the child, and points to the need to help those who work with children to develop moderately permissive attitudes.

Case studies suggested need for exploration of a larger group of lax and overindulgent mothers; refinement of attitude surveys to measure more accurately the degree of restrictiveness or overindulgence, the kind of attitudes to which the child was exposed during important periods in his past life, and to allow for more accurate evaluation of inconsistent and uncertain mothers; further refinement

of methods of classifying children's emotional disorders to decrease overlapping; inclusion of fathers in attitude studies to gain a clearer picture of the attitudes to which the children are exposed. 103 pages. $2.00. Mic 57-1420

PERSONALITY FACTORS IN MOTHERS OF CEREBRAL PALSIED CHILDREN

(Publication No. 20,572)

Glen Boles, Ph.D.
Columbia University, 1957

The purpose of this investigation was to determine whether mothers of cerebral palsied children constituted a special group with respect to personality characteristics as correlates of having given birth to a handicapped child.

Hypotheses were established for seven areas of personality functioning as follows: mothers of cerebral palsied children are more 1) anxious, 2) guilty, 3) overprotective, 4) rejecting, 5) unrealistic, 6) maritally conflicted, and 7) socially withdrawn than mothers of nonhandicapped children. It was further sub-hypothesized that each of these characteristics would vary according to the age of the child and/or the religious affiliation of the mother.

An experimental group consisting of 60 mothers of cerebral palsied children and a control group consisting of 60 mothers of nonhandicapped children were established. In order to test the sub-hypotheses the population was selected so as to equally represent mothers of younger and older children, and as well mothers of the three major religious groups, Catholic, Jewish, and Protestant. Subjects in the experimental and control groups were equated by matched-group procedure on 10 variables. A wide socio-economic range was represented by the subjects, and all shared a similar geographical environment.

Mothers' attitudes were elicited through a self-administered questionnaire comprising items in the seven areas of personality outlined by the hypotheses. Items for the various scales were constructed by the investigator of the present study, with the exception of the Anxiety Scale which consisted of the 50 scored items of the Taylor Manifest Anxiety Scale. The questionnaire was administered alike to all subjects.

Raw scores obtained from the questionnaire were compared by a triple analysis of variance. This statistical treatment allowed for a simultaneous examination of the hypotheses and sub-hypotheses of this experiment. F-ratios were computed to establish the significance of differences between the experimental and control groups for each of the seven personality factors under consideration. The significance of differences between groups was also established when the age of the child or the religious affiliation of the mother was compared. Interaction effects among the three dimensions, condition of the child, age of the child, and religious affiliation of the mother, were also examined.

Mothers of cerebral palsied children were found to be significantly more overprotective and maritally conflicted than mothers of nonhandicapped children. Mothers of older children, both of cerebral palsied and nonhandicapped children, were found to be significantly more guilty, rejecting, and unrealistic than mothers of younger children. Mothers of younger cerebral palsied children were found to be significantly more socially withdrawn than mothers of older cerebral palsied children. Catholic mothers in both groups were found to be significantly more guilty, unrealistic, and socially withdrawn than Jewish mothers. Catholic mothers of cerebral palsied children evidenced significantly more retributive guilt and were found to hold significantly more unrealistic expectations for their children's improvement and future life adjustments than Jewish mothers. Jewish mothers were found to provide significantly more social opportunities for their cerebral palsied children than either Catholic or Protestant mothers. Protestant mothers of both groups were found to be significantly less anxious and less socially withdrawn than Catholic and Jewish mothers combined.

The findings of this study revealed that mothers of cerebral palsied children may be characterized as overprotective and maritally conflicted as correlates of having a cerebral palsied child. Although no significant differences between mothers of cerebral palsied and nonhandicapped children were found with respect to anxiety, guilt, rejection, and unrealistic attitudes, it is noteworthy that these characteristics were evidenced in marked degree in mothers of both groups. Both the age of the child and the religious affiliation of the mother were found to be significant factors in mothers of both cerebral palsied and nonhandicapped children as correlates of specific characteristics of personality. 155 pages. $2.05. Mic 57-1421

A STUDY OF THE RELATIONSHIP BETWEEN BOYS' PERCEPTION OF PARENTAL ATTITUDES AND THEIR PREDELINQUENCY

(Publication No. 20,276)

Jacob Chwast, Ph.D.
New York University, 1956

Chairman: Professor Bernard N. Kalinkowitz

The purpose of this investigation was to determine statistically significant differences, if any, between predelinquent and non-predelinquent boys concerning: (1) their expressed attitudes regarding mothers, fathers, and parents in general, (2) their underlying attitudes regarding mothers and fathers, and (3) the discrepancy between their expressed and underlying attitudes regarding mothers and fathers.

It was hypothesized that predelinquents would expressly state their mothers, fathers, and parents in general were more dominating, more ignoring, and less possessive than non-predelinquents. Second, predelinquents would perceive mothers and fathers as more dominating, more ignoring, and less possessive than non-predelinquents on a deeper level. Third, predelinquents would significantly differ from non-predelinquents in the discrepancies between expressed and deeper attitudes as follows: (a) predelinquents stating mothers and fathers were possessive would not thus see them on a deeper level, unlike predelinquents who would, (b) predelinquents stating mothers and fathers were ignoring would thus see them on a deeper level, while predelinquents would not. Fourth, no differences would occur for mothers' and fathers' dominating.

Most authorities agree upon the primary importance of parent-child relationships relative to personality development and behavior, but no study using testing methods has been made of predelinquents' attitudes concerning mothers and fathers at two levels of awareness.

In the present study, thirty predelinquent boys were compared to thirty non-predelinquent boys. All were between the ages of twelve and sixteen years. They came from similar low socio-economic neighborhoods. In each case, both natural parents were alive and resided at home. All families had lived in this country at least eight years. No boy had ever been arrested. None had ever had any severe physical handicap or organic brain condition. A minimum I.Q. of 80 was required for all boys.

Expressed attitudes regarding mothers, fathers, and parents in general were elicited by the Child-Parent Relationship Scale; while, projective thematic pictures tapped underlying attitudes, rated by judges for intensity.

The results were as follows:

Predelinquents expressly stated their mothers were more possessive than non-predelinquents (5% level of confidence), and more ignoring (1% level). Predelinquents were more variable than non-predelinquents about mothers' dominating (5% level), and ignoring (1% level).

Predelinquents expressly stated their fathers were more dominating and ignoring than non-predelinquents (5% level), and more possessive (2% level). They were more variable than non-predelinquents for dominating and ignoring (1% level).

Predelinquents expressly stated that parents in general were more ignoring (1% level).

Predelinquents expressly stated that parents displayed more undesirable attitudes toward them, and were more variable in this respect than non-predelinquents (1% level).

On a deeper level, predelinquents saw mothers as more ignoring and less possessive (1% level). They showed greater variability regarding mothers' ignoring (1% level).

Fathers, on a deeper level, were seen by predelinquents as more ignoring and less possessive (1% level). For predelinquents, greater variability occurred regarding fathers' ignoring (5% level).

On a deeper level, predelinquents saw mothers and fathers as displaying more undesirable attitudes toward them (1% level). They were also more variable about this than non-predelinquents (1% level).

Predelinquents were more discrepant than non-predelinquents between expressed and deeper level attitudes of mothers' and fathers' possessiveness (1% level).

They were less discrepant than non-predelinquents for ignoring by fathers (2% level).

No significant differences in discrepancies occurred between the groups for mothers' and fathers' dominating.

The conclusion seems valid that the predelinquents, as defined in this study, are a group distinguishable in attitudes about parents from socially conforming children. Exploring differential responses at varying levels of awareness appears promising for research, psychodiagnosis and psychotherapy. 180 pages. $2.35. Mic 57-1422

A STUDY OF THE EFFECT OF DEPENDENCY AND OTHER PERSONALITY CHARACTERISTICS ON AIRMEN IN A FAMILIAR CRISIS SITUATION

(Publication No. 20,282)

Philip L. Goldberg, Ph.D.
New York University, 1956

Problem

Speeds and heights never experienced before in aviation are being tested by flying personnel in a variety of devices. Among these devices is a low pressure altitude chamber in which airmen have manifested notable anxiety. The psychological factors behind this chamber anxiety in experienced airmen have become an important problem in aircrew training. The purpose of this investigation is to determine the effect, if any, of a measure of dependence on a manifestation of anxiety when undergoing low pressure altitude test chamber exercises under physical conditions of maximum control and safety.

Population

The subjects of the research were two groups of 25 each, of flying personnel of the United States Air Force. All were males, white, on active duty, and had been through the low pressure altitude chamber at least once previous to the chamber flight in this study. The experimental group were men who, observed by the physiologists at the chamber, had given evidence of chamber anxiety according to a previously agreed on set of criteria. The control group, matched for age, rank, education, years of service, and intelligence were airmen who showed no signs of chamber anxiety according to the same criteria.

Procedure

The men in both groups were given a self-rating Dependency Scale and the Rorschach Test. The Dependency Scale was sorted according to the Q sort technique with the factors of "dependency-independency" being measured while the social desirability of the items was controlled.

The Rorschach Test was administered and scored by the investigator and the anonymous protocols submitted to three independent psychologist judges for rating of eight Rorschach personality characteristics and the characteristic of dependency. The ratings were accomplished on a four point scale (with midpoints intervening), each point being qualitatively defined. Additionally the judges were asked to identify and separate the experimental and control groups utilizing the entire Rorschach records.

Findings

The results obtained within the limitations of the tests and the procedure were as follows:

1. There was no significant difference between the anxious and non-anxious chamber groups in terms of dependency as rated on the Dependency Scale.
2. There was no significant difference between the groups on the characteristic of dependency as rated by the judges using the Rorschach Test.
3. The judges, using the Rorschach, were unable to agree with any sufficient reliability on six of the nine characteristics.
4. On the two characteristics, other than dependency,

upon which the judges showed significant inter-judge reliability, the judges did not identify the criterion groups beyond chance expectations.

5. When the judges tried to pick which group the subjects belonged in, using the unidentified Rorschach Records, there was significant inter-judge agreement between two of the three pairs of judges. However, the judges agreed in error in that they did not successfully place the men in the proper groups on a better than chance basis.

Conclusions

Dependency as measured by our two psychological instruments does not appear to be connected with anxiety such as is manifested in a familiar crisis situation.

The characteristics of adequacy and flexibility as identified on the Rorschach by independent judges do not seem to be connected with chamber anxiety.

The Rorschach test when used by judges who have not themselves administered the test tends to have little inter-judge reliability on judgments of common personality characteristics.

The use of anonymous Rorschach protocols by judges in "blind analysis" (i.e. non-clinical) in separating anxious from non-anxious subjects is questionable.

The findings of this study in regard to the use of the Rorschach in a crisis situation are compatible with previous studies. 160 pages. $2.10. Mic 57-1424

AN INVESTIGATION OF THE NATURE OF CONCEPT FORMATION IN CEREBRAL PALSIED SCHOOL CHILDREN

(Publication No. 20,207)

John Edward Jordan, Ph.D.
Michigan State University, 1956

The Problem

This study was concerned with ascertaining some of the characteristics of concept formation in cerebral palsied school children. Its major objective was to determine the relationship of mental age to certain aspects of conceptualization. Specifically the study attempted to test two hypotheses:

1. There is a positive relationship between mental age and the various aspects of conceptual functioning in cerebral palsied children.
2. Concept formation ability is more highly related to mental age than to kind of cerebral palsy or degree of disability.

The Sample

The sample consisted of thirty cerebral palsied school children from the Lansing, Michigan Public Schools. They ranged in age from 4.6 to 20.1 with a mean age of 10.3 and a standard deviation of 3.10. The mental ages ranged from 2.8 to 17.1 with a mean of 8.44 and a standard deviation of 3.92.

Procedure and Methodology

Scores were obtained for all the subjects on the following variables:

1. Mental Age. The Stanford-Binet Intelligence Scale was used to obtain the mental age of the subjects. The Columbia Mental Maturity Scale was also used as a check on the Binet scores.
2. Concept Formation. A concept formation test of the sorting type was used which permitted a maximum of six logical concepts to be attained.
3. Physical Disability. The subjects were ranked for degree of physical disability by two physical therapists and an occupational therapist who knew the subjects well. The rankings were based on the medical records and the muscle tests given by the therapists.
4. Speech and Language Disability. Fifteen of the subjects were receiving speech therapy. They were ranked as to degree of speech and language disability: both remedial and developmental-wise; attempting to rule out the psychological factors.
5. Kind of Cerebral Palsy. This was determined from the medical records and the professional opinion of the therapists.

Statistical analysis of the relationship of mental age to these variables was investigated by means of correlations or correlation-like statistics and tests for the significance of the differences. The statistics accounted for the small sample and the rank order of some of the data.

Results

1. Mental age was a significantly better predictor of concept formation ability, than was degree of physical disability or kind of cerebral palsy as represented by spasticity versus non-spasticity.
2. Illogical conceptual responses were more characteristic of the spastic versus the non-spastic than were repetitive responses.
3. Normal children were significantly superior to cerebral palsied children in all aspects of concept formation ability.
4. The cerebral palsied group were significantly more variable than the normal on the number of logical and bi-dimensional concepts achieved, and less variable on mean time per concept and on the number of non-functional concepts produced.

90 pages. $2.00. Mic 57-1425

READINESS FOR, AND SUCCESS IN GROUP PSYCHOTHERAPY: A STUDY OF THE ABILITY OF CERTAIN SOCIAL, FAMILIAL, AND PERSONALITY FACTORS TO PERMIT PREDICTION OF SUCCESS IN GROUP PSYCHOTHERAPY

(Publication No. 20,287)

Milton Kaufman, Ed.D.
New York University, 1956

Chairman: Professor Edward L. Kemp

The main purpose of this study was the evaluation of the readiness concept in group psychotherapy. According to this notion, success in group therapy could be predicted from certain social and personality variables. Among the most frequently mentioned of these factors are: I Past Group Experiences, II Neurotic Symptoms, III Frustration Tolerance, IV Desire to Relate to Others, and V Attitudes Toward Siblings.

In order to permit experimental verification of this concept, quantification of the above stated factors was required. A five point rating scale was constructed for each of the above state factors.

The subjects of this study consisted of 24 adolescent delinquents referred for treatment to the Psychiatric Clinic of the Children's Court of New York for group therapy.

These children were organized into the following groups: (a) seven girls, treated by a female social worker, (b) seven boys, treated by a male psychiatrist, (c) six boys, treated by a male social worker, and (d) four boys, treated by a male psychiatrist.

Each subject was rated by three judges (staff psychologists) on each of the five factors. This was done before and after 26 therapeutic sessions.

The following results were obtained.

1. The four groups were found to be homogeneous with regard to the factors employed, before, as well as after, therapy. This demonstrates the comparability of the subjects and the therapists.

2. There was significant interjudge agreement in rating the subjects on each factor, before, as well as after, therapy.

3. The group, as a whole, demonstrated significant improvement on each factor, and on all factors combined, after therapy. However, when improvement was defined according to a more stringent criterion, there was no significant improvement on any factor, nor on the combined factors, after therapy.

4. (a) The high, positive, and significant correlations of the group from pre- to posttherapy on all factors, singly and in total, demonstrated that the group tended to maintain the same relative rank after therapy that they had had before therapy. Thus, regardless of the amount of improvement, the relative clinical status of most subjects remained the same after therapy.

(b) Correlation among the five factors indicated a slight, positive relationship, before, as well as after, therapy. This nonsignificant relationship demonstrates the relative independence of the factors employed in this study.

5. (a) The major prediction based on the readiness hypothesis, was that a greater frequency of subjects with high, rather than low, pretherapy ratings would improve after therapy. This prediction was not borne out for any, or for all factors considered. When a more stringent criterion for improvement was employed, however, there was a strong, although nonsignificant tendency for more frequent improvement in the low-rating subjects.

(b) A further series of statistical comparisons was made to determine whether the subjects who improved according to a stringent criterion, rated high or low, as compared with those who failed to improve. The results of this analysis demonstrated the following significant findings. Those who improved began therapy with significantly lower ratings than those who failed to improve, on paired, and total combinations of factors I, II, and V.

(c) Thus, not only was the readiness hypothesis refuted, but the opposite relationship was obtained, demonstrating that the lower the pretherapy rating on certain factors, the greater the tendency to improve.

It was concluded that the practice of rejecting individuals with "low-readiness" should be re-evaluated in light of the present findings. It is believed that those who are frequently rated low in readiness comprise two populations: (a) those intractable to this form of therapy, i.e., psychotics, brain-damaged, etc., and (b) those amenable to group therapy, i.e., severely neurotic, etc. It was suggested that the discrepancy between the present results and the clinical concept of readiness was based on the prevalent tendency to equate degree of improvement with ultimate clinical status. Thus, the present study indicated that despite the ultimate, relatively low clinical status of those with low, pretherapy ratings, this group benefited most from therapy. 163 pages. $2.15. Mic 57-1426

PARENTAL ATTITUDES IN SCHIZOPHRENIA

(Publication No. 20,388)

Florence Rita Mainord, Ph.D.
University of Washington, 1956

This study investigated the differences between the parents of a group of adult male schizophrenics and a comparable group of parents of adult male nonschizophrenics in their attitudes toward child rearing and in several personality variables. The groups were matched on relevant variables. Each subject completed a Child Rearing Attitude Scale and an Edwards Personal Preference Schedule. The CRAS consisted of 9 subscales derived by clinical and empirical techniques. The scales were designed to yield data whose analysis would be meaningful in light of previous reports in the literature. The nine subscales were Martyrdom, Moralistic, Overt Domination, Perfectionistic, Punitive, Overt Rejection, Subtle Domination, Overprotective and Democratic.

The mothers of the schizophrenics emerged as more martyred, moralistic, perfectionistic, rejecting, overprotective and subtly dominating than the control mothers. Three scales failed to discriminate the two groups: overt domination, punitive and democratic. Interpretation of these findings stressed the apparent tolerance of children for techniques of parental control which are overt, explicit and clearly verbalized. The difficulties likely to accrue from more subtle and insidious techniques of restricting children were pointed out.

Empirical investigation of paternal attitudes revealed

that the experimental fathers obtained significantly higher scores on the first eight of subscales listed above than did the control fathers. There were no differences on the Democratic scale. It was observed that in general the fathers obtained higher scores than the mothers, but that this effect was more marked in the experimental group. Interpretation of these results, therefore, was not clear-cut. One tentative interpretation advanced was that the fathers of schizophrenics offer passive support to the undesirable child rearing practices of their wives. It was also pointed out that fathers are less used to expressing attitudes about child rearing than are mothers. The necessity for further standardization of the attitude scale on fathers was indicated as was the need to additionally explore the relationship between the father and mother to properly assess the paternal child rearing attitudes.

The EPPS profiles were similar for the fathers and mothers of both groups with several exceptions. The profiles obtained were consistent with previous finding on elderly subjects and showed marked deviations from the norm group on several scales; high needs Deference, Order and Endurance, and low needs Exhibitionism and Heterosexuality. Of the six hypotheses advanced concerning the mothers, only one was supported by the data, e.g., experimental mothers had a lower need Affiliation than control mothers. In addition, experimental mothers had a higher need Intraception and a lower need Change than control mothers. The data supported the hypothesis that experimental fathers have a higher need Succorance than control fathers. Experimental fathers also have a lower need Heterosexuality than control fathers.

The data failed to support the hypothesis that experimental mothers would describe themselves by endorsing more statements of high social desirability value and fewer statements of low social desirability value than control mothers.

The data failed to support the hypothesis that the mothers and fathers of schizophrenics would hold less consistent child rearing attitudes than the control parents.

Empirical investigation of the relationship between child rearing attitudes and personal needs yielded 40 significant correlations out of 135 correlations computed. The data supported the hypothesis of a positive relationship between (1) need Nurturance and Overprotectiveness and (2) need Order and Perfectionistic attitudes but failed to support the hypothesis of positive relationship between need Aggression and Punitiveness.

106 pages. $2.00. Mic 57-1427

AN INTERPRETATION AND EVALUATION OF CERTAIN PERSONALITY CHARACTERISTICS INVOLVED IN CREATIVE PRODUCTION: AN INVESTIGATION AND EVALUATION OF PERSONALITY STRUCTURE AND CHARACTERISTICS OF CREATIVE INDIVIDUALS IN THE CONTEXT OF PSYCHOANALYTIC THEORY AND EGO PSYCHOLOGY

(Publication No. 19,998)

Walter David Myden, Ph.D.
New York University, 1956

The problem was to determine what are the personality characteristics involved in creative production. If such a determination could be made, such personality characteristics would be interpreted in the light of psychoanalytic theory and ego-psychology. Special emphasis was placed upon primary process, repression and sexual ambivalence which were hypothesized to be crucial factors involved in creative production.

Twenty recognized creatively productive individuals actively engaged in the fields of painting, writing, composing, and choreography were compared with twenty eminently successful industrialists and professional individuals. The subjects in the two groups were equated for age, sex and socio-economic status.

The comparison between the two groups was made on the basis of the Bender-Gestalt, the Rorschach, the Thematic Apperception Test, Human Figure Drawings and the Vigotsky Concept Formation Test. The protocols resulting from these tests were scored according to standard manuals of procedures. These results were then evaluated for the significance of the differences by means of the non-parametric chi-square test employing the combined medians of the two groups being compared. Where percentages were considered, Fisher's "t" test for the null hypothesis was used. The qualitative results of the tests were also compared.

When these results were compared marked differences in the personality dynamics of the creative and the non-creative groups were found.

The creative group was found to use significantly greater amounts of primary thought process without an increase in anxiety. Thus the primary process in this group appeared neither to arise from a loss of control due to anxiety nor to produce further anxiety as it came into awareness. The creative group also produced significantly fewer signs of repression. They also revealed evidence of greater sexual ambivalence than did the non-creative group. This may be due to the significantly higher incidence of primary process and the lower employment of repression than was found in the non-creative group. In the creative group, the use of primary process was usually accompanied by successful reality testing.

The subjects in the creative group produced evidence of possessing superior intellectual ability and to be functioning on a level close to their potential. They revealed a strong fantasy life combined with energies which could translate such fantasies into creative productions. Their basic primary affect to external stimuli is greater than that of the non-creative group, but at the same time the creative group revealed a telling amount of inner-directedness and introversiveness.

The summarized findings were:

The projective tests, especially the Rorschach could differentiate a syndrome of personality characteristics in the creative population.

The key characteristics appear to consist of a personality constellation in which primary thought process is not repressed but is integrated with secondary or intellectualized thought processes. These personalities combine this with marked introversive trends and inner-directedness. At the same time, they possess a high degree of basic affect toward external stimuli. These personality characteristics, when combined with superior intellectual endowment and a well organized ego appear to be the sources of creative drives and the control necessary to convert inner fantasies into creative production.

The non-creative group, on the other hand, revealed

evidence of being more strongly outer directed and conforming than the creative group. Among the non-creative group, where there were evidences of primary process these were usually accompanied by increases in evidences of anxiety. Repression appeared to be a primary defense. As a result, while the non-creative group consisted of people with superior intellectual endowment, they appeared to be functioning on a level below their potential. Their basic primary affect to external stimuli was significantly lower than for the creative group despite the evidence of trends toward outer-directedness and conformity on the part of the non-creative group subjects.

154 pages. $2.05. Mic 57-1429

THE RELATIONSHIP BETWEEN TWO MEASURES OF INTERVIEW BEHAVIOR COMPARING VERBAL CONTENT AND VERBAL TEMPORAL PATTERNS OF INTERACTION

(Publication No. 20,759)

Jeanne Shirley Phillips, Ph.D.
Washington University, 1957

Chairman: Professor Frederick H. Kanfer

The purpose of this study was to investigate the degree of relationship between constructs utilized in verbal content analysis and temporally defined analyses of psychotherapeutic interviews. These two methodologies, both in current use in investigating the internal dimension of psychotherapy, involve data at two levels of observation: the objective level of what the patient does, and the subjective level of what the patient says about himself. The Interaction Chronograph was used as the temporal measure of verbal behavior. This method records reliably such variables as how often a patient talks, the duration of his utterances and silences, how often he interrupts, whether he dominates or submits when interrupted, et cetera. The development and reliable application of a system of content analysis, utilizing the resources offered by other studies, was a major methodological purpose of the investigation.

Hypotheses were formulated concerning possible relationships between the descriptive constructs of the two systems. Pilot studies were performed to develop a content system based on these constructs. This system utilized the Kaiser Interpersonal System and newly developed categories dealing with eight other proposed dimensions:

a) description versus direction interaction with the therapist versus unscorable

b) time reference

c) orientation to self or to others (in use as subjects of description)

d) number of different classes of others described

e) description of action versus of states of being, attitudes, et cetera

f) interpersonal versus non-interpersonal description

g) nature of described interpersonal interactions (Kaiser System)

h) nature of described non-interpersonal states and events

i) number of different topics discussed

The unitizing and categorizing processes involved in the application of this system were examined and found to be reliable.

A group of thirty randomly selected outpatients from the Psychiatric Clinic of an urban medical center were seen by one psychiatrist who conducted a standardized interview. Simultaneous recordings of the content and temporal pattern of the patient's verbal behavior were made.

Typed protocols of the interviews were analyzed by the content system and percentage scores for categories were obtained. When these content scores were intercorrelated and cluster analyzed, five clusters of variables were obtained. The specific inter-category correlations suggested that the content of patients may be described as being either "inwardly" or "outwardly" oriented, as giving more or less emphasis to the self or to others. Hostile-submissive interpersonal attitudes were related to "inward orientation" while hostile-dominant or positive-dominant interpersonal attitudes were associated with "outward orientation".

The correlations between chronograph and content variables did not support the specific formulations of the original hypotheses drawn from Chapple. Unpredicted relationships were found to suggest alternative constructs relating IC and content. The results indicated that "inward oriented" patients talk less freely and with less self reliance, and are more hesitant in responding. "Outward oriented" patients show the reverse pattern for chronograph measures. In addition, the correlations suggested that those outward oriented patients who emphasized others in their own right were more Dominant, in chronograph terms, while others who emphasized others only as they related to the self were less Dominant.

The findings therefore show some congruence of the constructs of these two methods and suggest concurrent validity of the temporal and content measures. Suggestions for further research include a replication study to cross-validate and possibly expand these findings, an examination of interviews with normals by means of the same variables, and an investigation of the two sets of constructs as process variables through time.

204 pages. $2.65. Mic 57-1430

A PERSONALITY STUDY OF TWO TYPES OF MURDERERS

(Publication No. 20,215)

Miles Dale Pothast, Ph.D.
Michigan State University, 1956

An exploratory personality study of forty convicted and imprisoned murderers was conducted by the use of the psychological tools of the Rorschach Test and the Minnesota Multiphasic Personality Inventory. These forty murderers consisted of a group of twenty men who had been convicted of murdering their wives (this group was

designated as "Passion" murderers) and a group of twenty men who had been convicted of murdering while committing armed robbery (this group was designated as "Profit" murderers).

These two murderer groups were equated closely as to age, I.Q., socio-economic background, color, and time spent in prison on present sentence. The results of their performance on the Rorschach Test and the M.M.P.I. was compared with each other, a prisoner group and a non-prisoner group.

Obtained results showed both murderer groups' performance to deviate considerably from that of the non-prisoner groups, to a much lesser extent from that of the prisoner groups and even in some aspects from each other, with the "Profit" murderer group being more deviant than the "Passion" murder group. Analysis of the findings of these M.M.P.I. and the Rorschach findings reveal the "Passion" murderers to be extremely immature, emotionally labile, easily disturbed and unable to form good interpersonal relationships, to utilize strongly repressive, neurotic type defenses, and to show a marked tendency toward antisocial behavior. The "Profit" murderers were found to be extremely immature psychologically and emotionally labile but did show a lesser tendency for emotional reaction than did the "Passion" group. Furthermore, the "Profit" group was found not only to be unable to form good interpersonal relationships, but to avoid close contact with others; showing a social as well as strong antisocial tendencies.

The obtained results lead to the implication of the presence of psychopathic personality types such as have been proposed by Gilbert (26), with the "Passion" murderer resembling the "hysterical psychopath" and the "Profit" murderer the "schizoid psychopath." Further evidence is needed in this area and it was suggested that analysis of similar data obtained from convicted murderers in other regions of this country would be helpful in evaluating the personality structures of murderers and that data from the members of other criminal categories, such as armed robbery, be evaluated and compared with that of murderers. 78 pages. $2.00. Mic 57-1431

RORSCHACH RESPONSES AS A FUNCTION OF EXPOSURE TIME

(Publication No. 20,297)

Milicent Tycko, Ph.D.
New York University, 1956

Problem and Procedure

The problem of this study was to differentiate between projective reactions elicited under four conditions of temporal exposure. The data were based upon responses of forty volunteer undergraduates to individual tachistoscopic presentation of the full set of Rorschach Cards at ascending exposure durations of: .03 seconds, .30 seconds, 3.0 seconds, and full exposure. Prior clinical administration of the Behn-Rorschach gave an independent measure of characteristic reactions. Statistical analysis of the changes in response variables as a function of exposure time, was facilitated by use of the IBM Type 650 Magnetic Drum Electronic Data Processing Machine.

Results

Responses to the initial brief exposure level were characterized by constriction, reliance on undifferentiated global approaches, meagre productivity, rejections and concrete descriptions, and poor form quality responses. At longer exposures, responses showed increased analytic fragmentation of blot areas, improved fit of percepts to formal blot structure, and greater organization of elements.

The dependence of both FM and M responses upon sustained encounter with the stimulus for formation and facilitation, indicated that these responses were based upon an interactive re-working of the stimulus, rather than being solely inner contributions of the perceiver to a fleeting external stimulus. Qualitative features of M responses suggested that conflictful, threatening, and disorganizing themes were aroused during the interplay of interpretive hypotheses with more sustained stimulus bombardment, rather than being "set off" in isolation from the stimulus features. The m responses depended upon breaking up of the masking effect of previous gestalts, and increased significantly only in the context of full interaction with the stimulus when critical awareness could be sharpened.

There was a marked increase in use of color at .30 seconds exposure; color responses were initially predominantly crude or undifferentiated, but an ascendancy of formal control and improved accuracy occurred at longer exposures. The only determinant which remained unaffected by increased exposure time was achromatic color.

Popular responses were not immediately inherent in the blots, but rather depended upon discovery through increased encounter, as did overall diversity in content.

Analysis of responses to different cards at .03 seconds exposure showed relatively long reaction times to Cards I, VI, VIII, and IX, with more rejections and descriptions of chromatic cards. Good form level occurred on Cards I, III, V, and VII, while poor form level occurred on Cards IV, VIII, and IX.

A complete correlation study between the Behn-Rorschach and the full exposure Rorschach indicated that the Behn elicited significantly higher: W, W%, dd, dd%, dr%, KF, KF%, cF, cF%, FC, FC%, "other color", "other color" %, A, A%, At, Pl, and "other content". The Behn elicited significantly lower: Cut-off W%, D%, M, M%, H, H%, Hd%, Ad%, and Obj%.

The M%, H plus (H)%, and At% on the Behn were significantly correlated with the percentages of corresponding variables at each of the brief exposures of the Rorschach. There were also significant correlations between Behn and corresponding Rorschach variables at one or two brief exposures in: W%, D%, F%, A%, Obj%, FM%, and "other color"%.

Conclusions

The variations in response over the series of four exposure levels suggest that broader aspects of the structure of personality may be tapped by widening the range of temporal conditions under which the Rorschach is administered. The major hypothesis of the study, that projection does not consist solely of contributory attribution of meaning to the blots, but is related to an interactive re-working of stimulus features during sustained encounter, was supported.

224 pages. $2.90. Mic 57-1432

THE FUNCTION OF RECALL AND CHOICE AS A PROJECTIVE DEVICE IN NORMAL, NEUROTIC, AND PSYCHOTIC MENTAL STATES

(Publication No. 17,680)

Leon Warshaw, Ph.D.
New York University, 1956

Purpose

The purpose of this investigation was to compare the recall and choice responses of normal, neurotic, and psychotic males to the perceptual stimuli of human facial pictures.

Hypotheses

The main hypotheses which guided the investigation were: 1. that the differential recall of pictures reflects non-verbal interpersonal preferences 2. that pictures chosen as liked reflect verbal interpersonal preferences 3. that the recall of pictures is positively related to adequacy of social adjustment and 4. that the recall of pictures is inversely related to severity of mental illness.

Methods and Procedures

The experimental subjects were 90 white males, equated for age and years of education, between the ages of 20 and 42, residents of either New York or Michigan, free of organic brain damage, not feebleminded, and accessible to interview and psychological testing.

The normal subjects were selected by the experimenter on the basis of past and present psychiatric history. The neurotic and psychotic patients were selected on the basis of psychiatric diagnosis.

Twelve judges; four normals, four neurotics, and four psychotics, selected in the same manner as the subject population, were used to obtain four groups of eight pictures in the following categories: young male-female pictures; masculine male-effeminate male pictures; masculine female-feminine female pictures; and middle aged male-middle aged female pictures.

Picture sets and name captions were presented to the subjects for eight seconds. Pictures and names were rotated for each administration. Subjects were asked for both immediate and delayed recalls and later to choose the four pictures of the eight liked best.

The validation criteria consisted of the evaluation by psychiatrists of the interpersonal preferences of their subjects for people in the same contrasting categories as those represented in the picture groups. This was accomplished by means of an Interpersonal Relations Form, which provided two levels of response, verbal and non-verbal. This procedure was undertaken only with neurotic subjects in psychotherapy. Choice preferences were tested against verbal and non-verbal preferences and recall preferences against non-verbal preferences by means of a chi square test. Overall social adjustment was obtained from the observations of a psychiatric staff of four: a psychiatrist, two psychiatric nurses, and an occupational therapist. The patients were divided into two groups: socially adjusted and socially maladjusted. A derived score based on the number of attempted immediate recalls, plus twice the number of attempted delayed recalls, minus the total error percentage of recall, was tested by means of a simple analysis of variance for its validity in measuring social adjustment as evaluated by the psychiatric staff. Another test was then made by means of a simple analysis of variance to determine the significance of the difference in mean derived scores for the normal, neurotic, and psychotic subject groups.

Results

The data revealed that the recall of pictures reflected non-verbal preferences (one percent level), but that the like choices of pictures did not validly reflect either verbal or non-verbal preferences.

The recall score mean of socially adjusted patients was significantly higher than the recall score mean of socially maladjusted patients (beyond the one percent level).

Recall score means of subject groups in the respective order of normal, neurotic, and psychotic were significantly higher than one another.

Conclusions

1. In comparison to like and dislike choice selection, even when the individual is fully aware of the meaning of presented stimuli, recall functions under low control by the individual.
2. The recall of human facial pictures is positively related to the adequacy of social adjustment.
3. Adequacy of social adjustment is inversely related to severity of mental illness.
4. The recall of human facial pictures involves factors other than positive motivation toward people i.e., attention, concentration, and organic memory capacity.

141 pages. $2.00. Mic 57-1433

THE EFFICACY OF ISONICOTINIC ACID HYDRAZID WITH SCHIZOPHRENIC CRIMINALS

(Publication No. 20,300)

Sheldon W. Weiss, Ph.D.
New York University, 1956

Chairman: Professor Charles E. Skinner

After being treated with Isonicotinic Acid Hydrazid for their tubercular condition, several patients of the Farview State Hospital for the Criminally Insane, Waymart, Pennsylvania, began to illustrate changes in their mentation toward a more rational mental status. In addition to stabilizing their tubercular infections, Isonicotinic Acid Hydrazid appeared to be responsible for a favorable reduction in the psychotic functioning of the patients. This study was initiated to ascertain the efficacy of utilizing this drug with non-tubercular psychotic criminals in order to evaluate its effect as a therapeutic agent in the treatment of a schizophrenic criminal population.

Sixty schizophrenic criminals were selected and divided into two equal groups: The Experimental Group (Group I) and The Control Group (Group II). The patients taking part in this investigation were limited to those between the ages of twenty and forty-five, non-tubercular, males, admitted to the hospital within six months of the initiation of the study, diagnosed in one of the sub-groups of schizophrenia, with a minimal intelligence quotient of ninety as measured by the Wechsler-Bellevue Intelligence

Scales. By means of t-tests, both groups were found comparable by the criteria of age, education, intelligence quotient, race and schizophrenic sub-group distribution.

Group I received a daily administration of two, one hundred milligram tablets of Isonicotinic Acid Hydrazid, while Group II received a placebo tablet in place of the drug. Both groups received no other therapeutic treatment or activity during the three month period of medication.

Standards for evaluation of pre- and post-treatment observations consisted of a comparison of both groups' performance upon a modified thematic apperceptive technique, the Rorschach Psycho-diagnostic test, the Minnesota Multiphasic Personality Inventory and a Behavioral Check-List derived from the patient's monthly Ward Progress Chart compiled by the medical staff.

The data were analyzed by appropriate statistical techniques with the results indicating that schizophrenic criminals treated with Isonicotinic Acid Hydrazid exhibit distinctive and significant changes from similar patients not so treated. Those patients receiving the drug illustrated significant decrease in their hallucinatory status as well as the tendency to be less irrelevant in their mentation.

Those under treatment with Isonicotinic Acid Hydrazid illustrated significant differences in terms of exhibiting a more elated and less depressed emotional climate on the projective techniques and devices used in this study than the patients receiving a placebo. There was also less projection of autistic and bizarre material such as delusions, ideas of reference and hallucinations on the part of the patients receiving the drug.

With the advent and progressive utilization of therapeutic drugs, new vistas of treatment for the mentally ill appear on the horizon. Large numbers of patients, hitherto unreached individually due to the deficiency of adequately trained personnel, may now be treated by gross pharmacological methods. This study is only one attempt in the arduous struggle against mental illness. Enlargement of future research to include civil schizophrenic patients can be anticipated as well as the utilization of Isonicotinic Acid Hydrazid in mental conditions other than schizophrenia.

124 pages. $2.00. Mic 57-1434

PSYCHOLOGY, EXPERIMENTAL

THE RELATIONSHIP BETWEEN VISUAL DISCRIMINATION AND CERTAIN PERSONALITY VARIABLES

(Publication No. 20,506)

George Milford Christensen, Ph.D.
University of Minnesota, 1956

This experimental study was based on the concept that individual differences in performance of perceptual tasks may in part occur because different persons use the perceptual apparatus in ways typical for the individual, but different from individual to individual, for the purpose of resolving conflict between inner strivings and the press of outer reality.

The independent variable consisted of performance on a visual perception task called the Squares Test. The Squares Test consisted of a series of 150 different sized squares projected one at a time on a screen. Subjects judged each square size and were given a score based on accuracy of size judgement.

Dependent variables were derived in part from responses of subjects to questionnaire items involving judgements by the individual subject of himself and his fellow group members on the basis of several personality characteristics. Other dependent variables consisted of total scores on the American Council on Education Psychological Examination for College Students (ACE) and scores for separate scales of the Minnesota Multiphasic Personality Inventory (MMPI).

Statistical techniques were used to test for relationship between the independent variable and each of the dependent variables. Male and female data were analyzed separately.

Subjects taking part in the study were the house members of three college fraternities, house members of three college sororities and members of four college classes.

The results of the study were in general negative. Except for isolated instances, there appeared to be no significant relationship between performance on the Squares Test and various dependent variables.

129 pages. $2.00. Mic 57-1435

ASSOCIATIVE INHIBITION AS A FUNCTION OF TEMPORAL INTERVAL AND WARM-UP

(Publication No. 20,490)

David Leigh Easley, Ph.D.
Vanderbilt University, 1956

Supervisor: Professor Leland E. Thune

The objective of the present experiment was to relate the findings on the warm-up factor in learning and retention to the investigation of negative transfer. It was suggested that the warm-up factor might be an unrecognized independent variable in some negative transfer situations. The two explicit purposes of the present study were: (a) to investigate the influence of the warm-up factor in a negative transfer situation in which the independent variable was the length of time between the learning on the two tasks, and (b) to determine the amounts of associative inhibition present with increases in the temporal interval (up through twenty-four hours) between the two tasks.

One hundred and twenty-eight Ss learned two lists of ten paired adjectives constructed by the A-B, A-B_R method. An interval of ten, thirty, sixty minutes, or twenty-four hours separated the end of learning on the first list (List I) and the initiation of learning on the second list (List II). One-half of the thirty-two Ss in each temporal interval condition received eight trials of warm-up practice on a color-guessing activity immediately prior to learning on List II. The order of learning the two lists was counterbalanced.

The following measures of learning on the second list constituted the dependent variable: (a) trials to criterion, (b) errors made in attaining the successive response criteria, (c) the number of correct responses on the first four anticipation trials, and (d) the number of overt

intrusions made during learning on List II. A 2 X 4 X 2 analysis of variance technique was employed in testing the significance of the results.

The combined warm-up groups attained the successive response criteria on List II slightly more rapidly than the combined no warm-up conditions. However, a comparison of the two groups separately for each temporal interval revealed that only the warm-up condition for the sixty minute interval was uniformly superior to its no warm-up condition throughout all stages of learning on List II. Furthermore, the differences between the warm-up and no warm-up conditions did not increase as a function of the temporal interval between learning on List I and learning on List II. It was concluded that the results of the present experiment (a) do not reveal a significant under-estimation in the amount of associative inhibition present resulting from the facilitating effects of the warm-up factor; nor, (b) do they reveal significant differences attributable to warm-up effects as a function of the temporal interval.

Although a significant warm-up effect from proprioceptive and attentive adjustments was not found in the learning on List II, it cannot be concluded that none was present. Two sources of possible explanation for the negative results of this experiment were examined--(a) the presence of an error in the experimental procedure or (b) an inappropriate basic assumption was employed in the present study. A thorough analysis of the procedure failed to reveal possible sources of error. It had been assumed that proprioceptive and attentive adjustments, found to account for a large part of the effects of the warm-up variable in learning and retention, would be adequate in explaining the effects of the warm-up variable in negative transfer. However, evidence was obtained which suggests that a "set to respond more frequently" with overt near-threshold responses might also be operative.

The relationship between associative inhibition and temporal interval for the initial stages of learning was consistent with Gibson's hypothesis deduced from her stimulus generalization theory of transfer. The amount of associative facilitation decreased with increases in the temporal interval up to the sixty minute interval at which point associative inhibition was obtained. The amount of associative inhibition decreased with further increases in the temporal interval up to the twenty-four hour interval where associative facilitation was found. During later stages of learning this relationship between associative inhibition and temporal interval was not obtained. It was suggested that the findings during later stages of learning may be a result of using the A-B, A-B_R method rather than the traditional A-B, A-K technique for producing interference.

It is recommended that future investigators attempt to isolate other factors of the effects of warm-up practice as well as the conditions of which they are a function. Such information is required before meaningful predictions of the effects of the warm-up variable can be made for complex situations in learning, retention, and transfer.

135 pages. $2.00. Mic 57-1436

THE INTEREST FACTOR IN UNDERGRADUATE ENGINEERING ACHIEVEMENT

(Publication No. 19,199)

George William England, Ph.D.
University of Minnesota, 1956

Adviser: Donald G. Paterson

Two engineering achievement scales on the Strong Vocational Interest Blank were developed on a sample of 218 men who registered in the Institute of Technology as entering freshmen in the fall of 1950.

Since the intent was to develop scales on the SVIB which would increase the accuracy of criterion prediction for engineering students when added to a present battery of predictors, the problem of keying items by a technique which takes into consideration the variation in the criterion already associated with the other predictors was considered. A "deviate technique" was utilized wherein responses of criterion groups are correlated with that part of the criterion variation which is not associated with presently used predictors.

The criterion to be predicted by the S-I Scale was fall quarter HPR. A multiple regression equation was written for predicting fall quarter HPR from HSRP (high school rank transformed to probit values) and CAAT. The predicted HPR for each student in the 1950 sample was subtracted from his actual HPR to obtain a distribution of residuals which represents that variation in the HPR criterion which is unaccounted for by the predictors CAAT and HSRP. High and low criterion groups were formed by selecting individuals in the upper and lower 27 per cent of the residual criterion distribution. The S-I Scale was keyed by assigning unit weights to SVIB responses which showed a differential of 17 per cent or greater between high and low criterion groups. The resulting S-I Scale was composed of 64 weighted responses on 48 of the 400 SVIB items.

The criterion to be predicted by the P-I Scale was No. Credits (P), a transformation to probit values of the number of credits completed in five academic years. A multiple regression equation was written for predicting No. Credits (P) from HSRP and CAAT. The predicted No. Credits (P) for each student in the 1950 sample was subtracted from his actual No. Credits (P) to obtain a distribution of residuals which represents that variation in the No. Credits (P) criterion which is unaccounted for by the predictors CAAT and HSRP. High and low criterion groups were formed in the same manner described for the S-I Scale. Use of the 17 per cent cutting point resulted in a P-I Scale composed of 41 weighted responses on 36 of the 400 SVIB items.

The two engineering achievement keys were evaluated on a cross-validation sample composed of 276 men who registered in the Institute of Technology as entering freshmen in the fall of 1952. It was found that the S-I Scale does not contribute significantly toward the prediction of HPR when combined with HSRP and CAAT, and that the P-I Scale does not contribute significantly toward the prediction of No. Credits (P) when combined with HSRP and CAAT. Within the limitations imposed by the samples and procedures employed, a generalization was made that special scales developed on the SVIB are not useful in the prediction of either college scholarship or persistence

to continue and complete a course of engineering studies when used in combination with an achievement test such as CAAT and a measure of previous scholarship such as HSRP.

A comparison of the effectiveness of the two engineering achievement scales found in the validation sample as opposed to the cross-validation findings indicated that acceptance of validation results would be definitely misleading. Results of this study clearly show the absolute necessity for employing some technique of cross-validation in endeavors similar to the present study.

116 pages. $2.00. Mic 57-1437

EIDETIC IMAGERY IN NORMAL AND PSYCHOTIC CASES: A STUDY IN THE INCIDENCE AND CHARACTERISTICS OF EIDETIC IMAGERY IN NORMAL AND PSYCHOTIC CASES, AND A COMPARATIVE ANALYSIS OF THE GROUPS

(Publication No. 19,986)

Lois Gray Floyd, Ph.D.
New York University, 1956

The study investigated the incidence and quality of visual and auditory eidetic imagery in groups of normal and psychotic individuals, to determine whether the eidetic phenomenon was more prevalent in hospitalized schizophrenics than in a "normal" population, and whether significant differences existed in the imagery of the two groups.

To date, few studies have been reported concerning auditory eidetic ability, particularly of adults. A secondary problem was to explore the incidence of auditory eideticism, in both adults and children, and to compare it with the visual phenomenon.

Forty adult psychotics, forty college students, and forty schizophrenic children were examined individually for after-images and visual and auditory eidetic images. The procedures for testing were adapted from the techniques used and validated by Klüver, Roessler, Peck and Walling, and the present investigator in an earlier study.

The performance of the schizophrenic adults was compared with that of the "normal" adults for incidence and characteristics of eidetic imagery. The schizophrenic children were contrasted with "normal" children of the same age range from a previous study by the experimenter.

Variations in incidence and quality of the imagery of the three groups were as follows:

(1) After-images: One hundred per cent of both adult groups and 87.5 per cent of the psychotic children reported after-images. Negative (complementary color) after-images appeared most frequently in all the groups, but 42 per cent of the psychotic adults, 25 per cent of the control adults, and 28 per cent of the psychotic children reported their images as achromatic. The after-images of the visually eidetic subjects were stronger, and more often colored than those of the non-eidetic.

(2) Visual eidetic images: One psychotic adult and six psychotic children reported visual eidetic images, making a total incidence of 5.8 per cent for the three groups. Fifteen per cent of the psychotic children were judged visually eidetic, as compared with a generally accepted incidence of from 30 to 40 per cent found in "normal" children. (Roessler, O'Neill, Kearney, and others).

(3) Auditory eidetic images: Thirty per cent of the psychotic adults as compared with 37.5 per cent of the "normal" adults reported auditory eidetic images. The psychotic children showed an incidence of 12.5 per cent as against 42 per cent found for "normal" children of the same age range.

All of the psychotic adults reported the intensity of their images as "like the stimulus", rather than louder or softer, and 75 per cent said the images were "continuous" rather than "intermittent". The "normal" adults indicated 60 per cent of their images as "softer than the stimulus", and 60 per cent as "continuous". The psychotic children reported more images as "like the stimulus" and more as "continuous" than "intermittent". The only conspicuous variation in characteristics occurred in the intensity of the images of the "normal" adult group.

The number of cases was considered too small to predicate reliable qualitative differences.

General Conclusions

(1) Eidetic imagery seemed less prevalent in psychotics, both adults and children, than in a "normal" population.

(2) The eidetic imagery of the psychotic did not appear to differ significantly from that of the "normal" as to quality or characteristics.

(3) Psychotic children reported approximately as much auditory eidetic ability as visual.

(4) More than twice as many psychotic adults as children indicated auditory eidetic ability.

(5) According to this experiment, visual eideticism tended to disappear in adulthood, while auditory eidetic ability did not decrease appreciably after puberty.

(6) Further testing involving a larger population is needed to verify these results.

98 pages. $2.00. Mic 57-1438

AN INVESTIGATION OF THE INDIVIDUALITY OF RESPIRATION PATTERNS IN THE HUMAN ADULT

(Publication No. 20,419)

Silas David Molyneaux, Ph.D.
Cornell University, 1956

In conducting the investigation described in this dissertation, the author wished to test two ideas; 1) whether the graph of respiratory airflow for an individual would remain constant with respect to one or more factors at several different times, if conditions remained constant; and 2) whether such graphs taken for different individuals could be classified into several categories, each with characteristics distinct from the others.

In the investigation, forty-eight young adults known to be in sound health were chosen and graphs of their respiratory airflow were made with the aid of a Benedict-Roth metabolism apparatus. The carbon dioxide in the exhaled air was not filtered out; the entire quantity of expired air was returned to the bell for mixing with remaining original gas, and subsequent rebreathing. The bell was filled with

oxygen at the start of each test. The airflow was graphed in ink on moving paper by suitable arrangements. All of the subjects made a second record approximately two weeks after the first one.

The resulting graphs were tabulated and analyzed according to the following factors: Amount of oxygen uptake, frequency, oxygen uptake divided by frequency, average motion from midpoint, maximum and minimum motion from midpoint, difference of this maximum and minimum as a percentage of the maximum, sum of all excursions (per minute), and ratio of inhalation time to exhalation time. Waveforms were also assigned descriptive symbols indicative of presence or absence of symmetry, the presence of sinusoidal or triangular shape, flatness of peaks, and the number of hesitations during inspiration, expiration, or both.

It was found that more of the factors used tend to identify the graphs of the same subjects taken on separate occasions, than were useful in distinguishing the graph of one subject from that of another. When the results of the two trials were compared the product-moment coefficient of correlation for frequency was 0.66, for 0_2 uptake divided by frequency was 0.40, for sum of the amplitudes under the curve was 0.54, and for inspiration time divided by expiration time it was 0.44. When the number of hesitations during inspiration was compared the chi-square calculation gave a result of 0.00. This calculation for hesitations during expiration gave a result of 0.20. The statistical analysis of the other factors mentioned above did not give a significant result.

As a means of differentiating between graphs of different persons, the configuration of stable factors just mentioned can be useful. The most valuable single factor for this purpose proved to be the wave pattern.

It is apparent that certain factors in the graph of one subject tend to remain constant on succeeding occasions providing conditions remain constant. It is more difficult to find a stable distinction between graphs of different subjects, but it seems probable that the waveform may be used at least to differentiate among a fairly large number of categories.

Such measures of respiration as have been employed in this study may well be useful in investigations of emotion, anxiety, and tension, and in work involving the detection of these elements. 188 pages. $2.45. Mic 57-1428

THE EFFECTS OF DELAY OF REINFORCEMENT UPON AN OPERANT DISCRIMINATION IN THE PIGEON

(Publication No. 20,638)

Jerome L. Myers, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor F. A. Mote

Three experiments on delayed reward learning in the pigeon were performed. The test apparatus was a Skinner Box. On each trial either a red or yellow light illuminated a transluscent lucite key for 10 sec. and the subject's rate of pecking at the key was measured. A 10 sec. period during which a blue light illuminated the key followed, regardless of which color had originally been presented. This delay period was terminated by a food reward only if it had been preceded by that color which had been apriori designated as the positive stimulus (red for half the subjects, yellow for the other half). Seventy-two trials were run each day and the experiment was continued until the birds reached a learning criterion based upon the rates of pecking to red and to yellow.

In Experiment I, four birds were run until the discrimination criterion was reached. From that point on, the key was not illuminated during the delay interval. Four other birds served as a control group. They were run for three days after the discrimination criterion was reached. The change in the delay condition did not appear to have any effect upon the attained discrimination.

In Experiment II, six birds were given special training to extinguish a pecking response to blue. These birds could not sustain a pecking response to the red and the yellow samples, until some consistent mode of responding was adopted during the delay interval. Once the birds began responding to the samples, they did not require significantly more trials to form the discrimination than did the birds in Experiment I.

In Experiment III, the birds were tested for reversal learning. Each time the statistical criterion was reached, reinforcement was shifted to the alternate color sample. This procedure was continued until the discrimination was attained on three successive days. Three additional reversals were run with the key dark during the delay interval.. A sudden decrease in the number of trials needed to reach criterion occurred at about the same time that the birds showed differential pecking behavior during the delay interval. This differential behavior dropped out when the delay condition was altered, and the reversal sets appeared to be impaired.

The applicability of Spence's secondary reinforcement delayed reward theory was discussed, and several objections were raised to the theory. Contrary to Spence's theory, it was concluded that neither differential external cues nor differential proprioceptive cues need be present during the delay interval in order for learning to occur. It was suggested that the superiority of the pigeons to the rats and chimpanzees in similar studies by Grice and Riesen, might bear investigation. It was also suggested that the difficulty of the discrimination problem may be an important variable. 83 pages. $2.00. Mic 57-1439

GENERALIZATION OF AN INSTRUMENTAL RESPONSE TO CIRCULAR AREAS WITH CONTROL OF VISUAL FRAME-OF-REFERENCE

(Publication No. 20,396)

Charles Van Riche, Jr.,
University of Washington, 1956

The problem of stimulus generalization is discussed in some detail in terms of a number of criticisms raised against past experiments offering evidence on the topic. It is argued that there is no clear-cut demonstration of 'pure' stimulus generalization or the gradient of generalization available in the literature. A more rigorous operational statement of stimulus generalization, than has previously been employed, is suggested and the experimental

work reported is designed to meet the requirements specified by this definition. The study involves the observation of running responses of white rats as related to changes in areal size of circular stimuli.

The measure of generalization utilized only the first test response of independent subjects at each of the stimulus levels under consideration. In order to control visual frame-of-reference cues, a special apparatus was devised. This apparatus, which incorporated automatic measurement of response latencies, may be briefly described as an open run-way leading to a twenty square foot vertical board on which is mounted the stimulus and the goal box. Stimulus intensity, defined in terms of the amount of white surface present on the stimulus board, was controlled by exposing black stimulus circles against an extensive white background.

One hundred forty-three animals were used. Ninety-six subjects were tested following a 24-hour delay since the last training trial, and 47 were tested following a delay of less than one minute. Each of these two delay groups was divided into sub-groups trained on the largest circular area or on the smallest circular area. The training groups were further subdivided into four experimental groups each, corresponding to the four stimulus levels under consideration. The general design is a two by two by four factorial design. Deviations from the strictly factorial design are indicated.

The results suggest that there is a differential response corresponding to the notion of stimulus generalization, which is independent of the training condition and which may not be significantly influenced by the delay condition. It is concluded that the phenomena associated with stimulus generalization in the visual modality are demonstrable under the most stringent conditions which can be set up within the Hullian framework, and there was no evidence of the influence of a stimulus intensity variable. The generalization gradient, as given by these data, is linear which contradicts the common assumption of a curvilinear function. However, as indicated, more subjects tested at more stimulus levels may be required for a better description of the shape of the generalization gradient. It was further concluded that a delay between training and test did not change the gradient other than by a scale factor which is attributable to a warm-up decrement. In terms of the observations of behavior during extinction it was concluded that, at least for this apparatus, the only useful measure of generalization was one which is a function of the first test trial only. And finally, in comparing these experiments with other research, it was pointed out that differences between various kinds of apparatus may influence different measures in different ways, thus yielding different generalization gradients.

81 pages. $2.00. Mic 57-1440

A PSYCHOPHYSICAL INVESTIGATION OF TRIANGULAR SHAPE

(Publication No. 19,874)

Donald Wyman Stilson, Ph.D.
University of Illinois, 1956

The main purpose of this study was to estimate the degree of relationship between certain physical properties of triangles and the variation in the degree of perceived similarity of these triangles. The entire experiment was replicated on two systematic samples of 13 triangles each. The triangles were all of the same area and differed only in shape.

Perceived similarity was measured by a distance function based on the frequency with which pairs of triangles were confused in a paired associate learning situation. These distances were used to imbed each sample of triangles in a euclidean space in which five dimensions accounted for approximately 90% of the total variation in the distances.

The linear correlations between each of these psychological dimensions of triangular similarity and each of the 14 physical measures of the triangles were then obtained. These were factor analyzed (using the method of principal components) in order to determine a set of loadings or projections of both physical measures and psychological dimensions on five "psychophysical" dimensions. From this psychophysical space, it was possible to estimate the upper limit of the degree of covariation between psychological dimensions and physical measures. This estimate was approximately 69% for both samples of triangles.

In order to obtain a lower limit for the degree of covariation between physical measures and the dimensions of perceived similarity, the multiple linear regression of each psychological dimension on three of the physical measures were obtained. These three physical measures were nearly statistically independent of one another, and they permitted the prediction of approximately 55% of the variation of the psychological distances in one sample of triangles and 47% in the other sample. Hence, estimates of the degree to which perceived similarity of triangles is dependent upon functions of the physical parts of the triangles ranged from 47% to 69%.

Evidence was found which suggested that physical measures other than those used in this investigation might increase the total covariation of perceived similarity and physical characteristics of triangles. There were also indications that the horizontal-vertical illusion influenced the perception of symmetry in the triangles.

130 pages. $2.00. Mic 57-1441

AN ANALYSIS OF SUBJECTIVE COLORS OBSERVED IN BLACK AND WHITE GRATING PATTERNS

(Publication No. 19,436)

Clyde Wallace Swink, Ph.D.
Purdue University, 1956

Major Professor: E. J. Asher

Several investigators (Abel, Luckiesh and Moss, Erb and Dallenbach, and Skinner) observed various colors while viewing stationary black and white stimulus patterns with the unaided eye. An adequate explanation for these "subjective colors" was not proposed. The author analyzed certain of these colors, both qualitatively and quantitatively, under various controlled conditions, and tested the hypothesis that the colors were the result of chromatic aberration in the lens system of the eye.

Using a specially designed optical instrument, two

identical grating patterns of equally spaced black and white bars were caused to be superimposed upon the retina of a single eye at six different degrees of overlap, ranging from black on black, through one whole cycle, to again black on black. The whole cycle was designated as 360°, thus making black on white 180° out of phase. In addition to degree of overlap, two other determinants, visual angle of the individual grating bars and dispersion angle of the colors in the white bars due to chromatic aberration, were either controlled or varied systematically.

Two basic types of observations were made:

1. Color patterns were subjectively observed for the six degrees of overlap when the visual angle was five times the dispersion angle, and when the visual angle was 1.5 times the dispersion angle.

2. The point of subjective disappearance of gray in the 180° gratings and the point of reappearance of gray in the 180° gratings were measured in terms of visual angle for three different dispersion angles. Dispersion angles were calculated from known constants of the eye using three different artificial pupil stops.

Results in both cases were compared with calculated color patterns based on Ostwald's system of color addition, postulating three ideal primaries for the composition of white light. The theoretical overlapping of colors dispersed by the eye lens was determined by Bouma's laws of "Boundary Colors". Calculated schematic color pattern diagrams for each degree of overlap and for several values of the ratio between visual angle and dispersion angle are included in the text.

All of the fifteen selected subjects reported color patterns indicating a high degree of correlation with calculated values for large visual angles. Where the ratio between the visual angle and the dispersion angle was less than two, observed colors became simplified to alternate complementary colors in the red-bluegreen range in contradistinction to the complex calculated color patterns. Gray disappeared between the alternate complementary colors in the 180° gratings at considerably larger visual angles than expected from calculations.

Both the simplification of colors and the premature disappearance of gray was interpreted as an indication that unspecified "induction" processes in the visual system operate to modify complex visual patterns at low visual angles.

The results are in accord with the hypothesis of chromatic aberration, and some of Hartridge's polychromatic theory as well as his theory of "antichromatic responses". The induction effects are not inconsistent with Motokawa's theory of "Retinal Induction".

101 pages. $2.00. Mic 57-1442

EFFECT OF PUNISHMENT ON HUMAN OPERANT BEHAVIOR

(Publication No. 19,438)

Robert Batchelder Tallarico, Ph.D.
Purdue University, 1956

Major Professor: L. M. Baker

Two integrated studies of punishment were made. These data were obtained concurrently.

In the first study punishment was defined as presenting a negative reinforcer to an organism. The hypothesis tested was that the effect of punishment would be greater on behavior that was more resistant to extinction.

The methodology required conditioning, punishing, and extinguishing a telegraph key-tapping response in human subjects. The experimental situation was a visual discrimination problem. Crediting points on a counter was the positive reinforcer, and subtracting points on a counter was the negative reinforcer.

Seventy-two experimentally naive introductory psychology students, equally divided between males and females, were employed. The experimental unit of the statistical analysis was the total score of the six males or females who were randomly assigned to a group.

Statistical analysis of the extinction data revealed that different resistances to extinction of the response were achieved. In the interval in which punishment was administered, the punished groups tapped less frequently than the nonpunished group. The difference between frequency of responding for the punished and nonpunished groups was significant at a higher level of significance for the two partial reinforcement schedules than for the continuous reinforcement schedule.

The second study compared the effects of presenting a negative reinforcer, of withdrawing a positive reinforcer, and of continuing positive reinforcement on behavior of the same resistance to extinction. These comparisons appeared to be of empirical and theoretical interest.

The methodology of the first study was employed. Forty-eight experimentally naive introductory psychology students, equally divided between males and females, were employed. The experimental unit was the same as the first study.

Statistical analysis of the extinction data revealed that compared to a reinforcement group, simple extinction significantly reduced the frequency of the key-tapping response, and negative reinforcement reduced the frequency even further.

It was argued that comparison of the effects between a group that received simple extinction and a group that was presented a negative reinforcer did not show the real effects of punishment. A control group that received reinforcement was perhaps a more suitable point of reference.

128 pages. $2.00. Mic 57-1443

STUDIES OF EXTERNALLY-AROUSED DRIVES IN THE RACCOON

(Publication No. 19,440)

Richard Irving Thackray, Ph.D.
Purdue University, 1956

Major Professor: K. M. Michels

The purpose of these studies was to investigate the role of curiosity and manipulation in the learning of the raccoon. More specifically, experiments were designed to determine whether these animals would learn a simple position response with manipulatory objects serving as the incentive. For both experiments a single-unit T maze,

with stimulus objects placed in one of the goal cages, served as the basic apparatus.

In the first experiment, three animals served as subjects. All were approximately one year of age with two being males and one a female. During the learning series, each animal was given a total of 55 trials for a period of 8 days, with the exception of one of the males whose learning series was terminated after 40 trials. During this series the manipulatory objects were always located in the left goal cage. A reversal series, with new stimulus objects in the opposite cage, was then conducted. Each animal received the same number of trials as was administered during the learning series.

The results indicated that only one animal, the female, showed significant learning during both series. Manipulation time for this animal remained at a constant high level with no apparent satiation.

A second investigation was conducted to provide further information concerning the role of curiosity and manipulation in the learning of these animals. Five young raccoons, approximately 3 months of age, served as subjects. Three were males and two were females. The basic apparatus was the same as that employed in the previous study. Thirty trials covering a period of 5 days, with manipulatory objects located in the left goal cage, served as the learning series. A reversal series was then conducted which differed from the preceding series only in that a set of new objects was attached to the right goal cage. To provide more information on possible satiation effects, the reversal series was continued for an additional 30 trials.

Four of the five animals demonstrated significant learning and reversal.

Latency of entry into the correct goal cage declined significantly during learning and remained at a constant low level during reversal and satiation series.

For three of the animals, a significant increase in manipulation occurred during the learning series followed by a significant decline during the satiation series. The other two animals revealed conflicting trends.

87 pages. $2.00. Mic 57-1444

EVALUATION OF A METHOD FOR THE CONSTRUCTION OF FACTOR-PURE APTITUDE TESTS

(Publication No. 20,766)

Milton Arlo Whitcomb, Ph.D.
Washington University, 1957

Chairman: Philip H. DuBois

This study was designed to determine the feasibility of applying the Loevinger-Gleser-DuBois technique of homogeneous keying to an aptitude area. The area chosen, spatial relations, is of current interest to the Air Force.

Homogeneous keying techniques were applied to a group of 180 spatial test items selected with intent to completely sample existing items in the space relations area. The subjects consisted of 1000 basic airmen. The resultant keys (tests) were checked for stability of their reliabilities and intercorrelations on an independent sample of 5000 basic airmen.

Nine keys were developed on the basis of the data furnished by the experimental sample of 1000 airmen. The median intercorrelation of the keys was .23 and the median reliability (KR 20) was .62. On the cross-validation sample of 500 airmen the median intercorrelation remained .23, while the median reliability was .60.

The method appears to be valuable when applied to an aptitude area. Though the method furnished much the same information as that gained from a factor analysis of an aptitude area, it has the advantage that the product of the method is a set of independent tests ready to be used, rather than a set of factors with many tests having varying loadings on them. However, one should realize that the pool of items selected for keying determines both the number and the homogeneity of the resultant tests. Therefore, care should be taken in determining the range of item variety, equalizing the number of items of each type, and limiting the range of item difficulty levels, so that the tests produced will be closely tailored to the needs of the requesting agency.

The following conclusions may be stated:

1. Homogeneous keying within an aptitude area is not only feasible, but worth while.
2. The resulting keys, though often not long enough to be of immediate use, do adequately indicate the direction for further interest and item construction so that useful tests may be developed.
3. The independence of the keys was greater than had been anticipated when compared to that of similar batteries in past studies.
4. The reliability and independence of the keys showed gratifying stability when tested on an independent sample. 77 pages. $2.00. Mic 57-1445

THE ESCHATOLOGY OF SECOND ISAIAH

(Publication No. 20,495)

Virgil H. Todd, Ph.D.
Vanderbilt University, 1956

Supervisor: Professor J. P. Hyatt

A preliminary problem in the study of the eschatology of Second Isaiah is the identification of the materials which may be rightly attributed to the prophet of the Exile. The prevailing opinion among critical scholars is accepted in this work, namely that Isaiah 40-55 was penned by an author somewhere around 540 B.C. The question of Chapters 34 and 35, attributed to Second Isaiah by some critics, was resolved principally upon the basis of their eschatology. Accordingly, Chapter 34 was assigned to the postexilic period and Chapter 35 to the prophet of the Exile.

In identifying the eschatological passages in Second Isaiah, the present writer has accepted a broad definition of eschatology, which includes the conception of a new kingdom established within this present spatio-temporal order without the destruction of the present cosmos. This study has shown also that the prophetic perspectives were commonly foreshortened. This was especially true in the case of Second Isaiah who perceived so keenly the inevitable triumph of God's purpose. His description of this coming age is sketched in terms of myth, a fact that has too generally been overlooked, and which has accordingly led some critics to label this prophet a "morally deficient skygazer" with an "unchecked imagination." In refuting such charges, the present writer has shown that the prophet's experience of the ultimately real was conceptualized and communicated to others through mythical terms which spoke of the sovereign and transforming power of God.

The Exile was a definite factor in the development of Second Isaiah's eschatology. A study of the actual conditions during the time of the Exile reveals the people's need for a message of hope and encouragement which would offset the pageantry, splendor, and color of the Babylonian cult confronting the exiles. This was achieved through an eschatological pageantry emerging from the prophet's hope in God's ultimate victory. The prophet believed that he and his people presently stood on the brink of that first act. The restoration from the Exile would actually effect a kind of realized eschatology, or be the prelude to the final act which would be initiated by God Himself.

Second Isaiah's thought is not altogether original, but has been influenced by the earlier prophets, in whose works the same basic eschatological tenets are discovered.

Finally, the eschatology of Second Isaiah has been used as a rather decisive criterion in the effort to determine the authorship of Isaiah 56-66. This study has shown that these chapters reflect conscious imitations of the Second Isaiah, but did not emerge from his hand.

200 pages. $2.60. Mic 57-1446

RELIGIOUS ORIENTATIONS OF UTAH SCIENTISTS RELATED TO CERTAIN PROBLEMS OF LATTER-DAY SAINT CHURCH EDUCATION

(Publication No. 18,708)

Richard Tracey Wootton, Ed.D.
University of Utah, 1956

Chairman: Dr. Dasil A. Smith

An objective of many educators in the Church of Jesus Christ of Latter-day Saints is to stimulate active faith in the Church and to increase appreciation for all truth, including the truths of science.

The purpose of this study was to obtain and interpret certain new data which may aid the educator in evaluating and achieving this objective.

Four hypotheses were set up and questionnaire items framed to obtain a type of data deemed likely to test the hypotheses and to cast light on the two problems mentioned. The hypotheses were:

1. Scientific minds can harmonize science with the Latter-day Saint religion. (Sometimes referred to as the "Science L.D.S. Religion Harmony Hypothesis.")
2. L.D.S. scientist "Believers" have favored "Flexible" viewpoints preponderantly, and have favored the "Flexible" viewpoints much more than did educated Latter-day Saint religion teachers not so cognizant of science. (Sometimes referred to as the "L.D.S. 'Believer' Viewpoint Hypothesis.")
3. A sizeable number of L.D.S. scientists have experienced emotional troubling while attempting to harmonize science and religion. (Sometimes referred to as the "Emotional Troubling Hypothesis".)
4. Utah scientists who had troublesome adjustments have made substantially more changes from "Literal" viewpoints than Utah scientists not so troubled. (Sometimes referred to as the "Adjustment Change Hypothesis".)

The conclusions from the data of this section were as follows:

1. That the first hypothesis was probably substantiated: Scientific minds can harmonize Science and L.D.S. Religion.
2. That the objective of stimulating active faith in the Church and also increasing appreciation for science can apparently be achieved to a significant degree.
3. That L.D.S. Church educators should probably be challenged to seek further improvement in the harmonizing of Science and the L.D.S. Religion, since sizeable percentages of L.D.S. scientists were only Nominal L.D.S., sizeable percentages did not believe Science and the L.D.S. Religion can be harmonized, and sizeable percentages were emotionally troubled during the science-religion adjustment process.

These findings substantiated the hypothesis that L.D.S. scientist "Believers" have favored "Flexible" viewpoints

preponderantly, and have favored the "Flexible" viewpoints much more than have educated Latter-day Saint religion teachers not so cognizant of science.

4. The third hypothesis, that a sizeable number of Latter-day Saint scientists have experienced emotional troubling while attempting to harmonize science and religion, was apparently true.

5. The fourth hypothesis was apparently untrue, that Utah scientists who had troublesome adjustments have made substantially more changes from "Literal" viewpoints than Utah scientists not so troubled.

6. Viewpoints originally held before changes in science-religion beliefs occurred, apparently did not make subsequent science-religion changes less troubling.

7. It appeared that it was not changes from any particular type of beliefs which this study could identify which caused the troubling but some as yet unidentified factors, if the scientists were right that the science-religion belief changes troubled them.

8. It appeared likely that the childhood science-religion beliefs among the L.D.S. "Strong Believers" and others were more often of the "Literal" than the "Flexible" type, since there were many more changes from "Literal" beliefs than from others as the scientists matured.

287 pages. $3.70. Mic 57-1447

SOCIAL PSYCHOLOGY

THE GREAT DEFENSE: A STUDY OF JEWISH ORTHODOXY IN MILWAUKEE

(Publication No. 20,643)

Howard William Polsky, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Howard Becker

The objective of the study was to analyze the interaction between a sacred religious system and the pattern of an American secular society. Jewish Orthodoxy was separated into three component elements: its organization, with the synagogue as the primary institutional structure, its membership and its role in the Jewish community.

The analysis of the development of orthodox organizations was facilitated by the use of the culture case method. Three constructed types of Orthodoxy development were detailed:

1. The basic tenets of Jewish Orthodoxy were analyzed in terms of their significance for ordering the prescribed-sacred social system of the East-European shtetl.

2. The transitional period in America was depicted where the sacred norms were challenged as the Orthodox immigrants took over American values in the daily endeavor of making a living.

3. As the economic position of the Orthodox Jews became stabilized, their system of traditional values became increasingly secularized, and this was postulated as the fundamental cause for the contemporary period of severe crisis. Here the focus centered upon the changing individual religious values and a detailed description of the disintegration of the binding traditional norms.

The Guttman scalogram was the chief research tool employed in the interviewing of 905 members of eight Orthodox synagogues in Milwaukee. The Orthodoxy scalogram which resulted evolved six scale types, which after being related to the demographic data and generation sequence in the questionnaire, revealed an apparently irreversible trend towards the abandonment of Orthodox rituals.

The abandonment of central traditional norms by the vast majority of Orthodox members was interpreted for its effects upon the changing synagogue. Two parallel organizations were described as emerging within the Orthodox synagogue: (1) an increasingly smaller, aging, foreign-born, largely retired, and somewhat prosperous conformist group, who traditionally managed the practical affairs of the synagogue and still pray daily at the synagogue, or at the least, regularly attend Sabbath morning services; (2) a newly emergent native born, relatively young businessman and professional group, who are organized in Mr. and Mrs. Clubs and Men's Clubs which have developed under synagogue sponsorship an essentially non-religious Jewish cultural and social program. Depending upon the influence of one of these two constellation of forces as against the other, institutional change is discussed, considered on a policy level in committee or on the board, or actually effected.

Within the Jewish community, the cumulative isolation of the strict Orthodox synagogue was demonstrated. As observant Jews assume less and less of an active role in the general Jewish community, the traditional norms become increasingly secularized in the direction of Reform and Conservative practice. As this occurs, Orthodox Jews as well as strictly Orthodox institutions become increasingly isolated in the Jewish community.

Thus individually, institutionally, and communally, the Jewish Orthodox movement in Milwaukee is assuming more and more the characteristics of a small isolated sect of followers of "Torah-true Judaism." Work and life in the American environment profoundly affected the traditional values and social organization of Milwaukee Jews. The behavior and attitudes of the majority of the Orthodox Jewish population inexorably changed in the direction of the abandonment of shtetl postures and in favor of the American middle-class way of life. Acceptance, rather than resistance to cultural change, became the norm.

Jewish Orthodoxy, having at its source the rich sacred accumulated heritage of two thousand years, balanced to some extent the secularizing tendencies of the American social system. The American Jewish community will continue its unique development without a significant traditional Jewish Orthodox movement in its midst; this will result in an acceleration of the process of secularization of Jewish religious traditions and raise new problems and challenges for the survival of Judaism in America.

458 pages. $5.85. Mic 57-1448

SOCIOLOGY, GENERAL

A COMPARATIVE STUDY OF THE DISTRIBUTION OF SOCIAL POWER IN ONE HUNDRED PRE-LITERATE SOCIETIES

(Publication No. 20,371)

John Augustine Broussard, Ph.D.
University of Washington, 1956

The main purpose of the present study has been to explore the area of social power through the use of cross-cultural techniques. In so doing, theoretical and empirical works in the area of power were briefly analyzed to show something of what has been done in this area of social and political science. Similarly, the cross-cultural or comparative cultural technique of social analysis was reviewed. Various studies, which have made use of this technique to analyze social phenomena, served as a basis for the application of cross-cultural methods to the study of social power.

In the main body of the present study, one hundred pre-literate societies were selected from the Human Relations Area Files and from library sources. These societies served as the sample from which data was drawn to test six hypotheses concerning the nature of social power. The results of the study indicated that power distribution in pre-literate societies has the following characteristics.

1. There is evidence to indicate that skills highly valued by a society can and do become a basis of power for individuals in the society versed in those skills.
2. One of the privileges accompanying high power position is greater accessability to sources of sexual satisfaction.
3. Organization is not a necessary concomitant of power. This finding may reflect the fact that the sample was representative of pre-literate societies, where social organization, in general, is of a less formal nature than in complex societies.
4. Power is seldom an isolated phenomenon, i.e., the control of one area of power serves as a basis for control of other areas.
5. There is a positive relationship between the number of areas of power controlled by the power holders and the dominance of this group in an area of high value.
6. Finally, the power position of a group takes much of its support from informal relationships and is seldom restricted to formal control.

The present study further indicates areas within the general field of power that may be explored with cross-cultural techniques. 131 pages. $2.00. Mic 57-1449

OFFICE LABOR UNIONISM IN THE UNITED STATES: ORIGIN, PRESENT STATUS, AND FUTURE

(Publication No. 20,274)

Bernard Elliott Budish, Ph.D.
New York University, 1956

This study is an examination of the origin, present status, and potential future of office labor unionism in the United States. Its results have been based on the attitudes of clerical workers towards unions; the background of office labor unionism prior to the enactment of the National Labor Relations Act; and the history of three office union organizations: the United Office and Professional Workers of America—CIO, the Office Employes International Union—AFL, and the Engineers and Salaried Employees Association, Local #300—UAW—CIO. From these results have emerged factors which may determine the future of clerical worker unionism in the United States.

The methods employed included an examination of the literature of the field: the publications of management organizations; union documents; and articles appearing in newspapers and magazines. Consideration was also given to the results achieved by Elmo Roper and the Opinion Research Corporation in their surveys of the attitudes of office workers. Finally, an analysis of interviews with, or questionnaires sent to, union and non-union office employees, officers of clerical union organizations, and office managers has been added. The replies were not considered statistically significant and were included only to add color to the study.

Inquiry into the office worker's attitude revealed that his antagonism toward unionization is declining because of the realization that his once high employee status is now reduced and that unionization regularly results in attractive labor-management contracts. However, it also showed that the clerical employee's resort to unionism is still being retarded by his close association with management.

Investigation into the history of office worker organization disclosed that the only clerical unions prior to 1935 were AFL federal labor unions. These locals had few members and received little assistance from the AFL. In 1937, the United Office and Professional Workers of America, an international union of office workers, was formed and affiliated with the CIO. Because of its industrial techniques, and vigorous organization methods, this Union secured an impressive membership. However, the refusal of the UOPWA officers to sign non-Communist oaths caused it to lose NLRB elections and encouraged companies to refuse bargaining recognition. Its final expulsion by the CIO brought the UOPWA into disrepute.

In 1945, the Office Employes International Union—AFL was organized. At first, the OEIU experienced difficulties. After 1953, however, with improved organizational techniques and new leadership, real growth took place, and today the OEIU is the only international office worker union affiliated with the AFL-CIO.

Despite the importance of the OEIU, a majority of the unionized clerical workers in the United States are enrolled in local unions of production organizations. An example is the Engineers and Salaried Employees Association (Local #300—UAW—CIO.) Local #300 suffers from domination by the large production local in the same plant, but this disadvantage is compensated for by the services rendered it by the production local and the parent international union.

This study, lends support to the following predictions regarding the future of office unionism. Despite the weak history of clerical unionism and the disintegration of the UOPWA, stable, though small, office unions like the OEIU and Local #300 will become more powerful as office employees become more receptive to unionization. The growth of office labor unionism will be slow for the next ten years. However, as the office worker's economic status weakens; as there is greater acceptance of union principles and tactics; as consistent support comes from the AFL-CIO; and as automation transforms office operations into mechanized routines; clerical unionism will be accelerated until office unions become forces of major importance in the economy.

352 pages. $4.50. Mic 57-1450

INSTITUTIONAL TREATMENT OF THE CRIMINALLY INSANE IN THE UNITED STATES

(Publication No. 17,573)

Frank LeGrande Magleby, Ph.D.
University of Utah, 1956

Chairman: Dr. Anthon S. Cannon

The Problem

There is a need to evaluate some of the diverse practices in the institutional treatment of the criminally insane. For example, the Colorado State Hospital provides similar custody and treatment for both the criminally insane and noncriminal patients. In some instances these patients work "side by side" on the hospital farm and in the occupational therapy shops. In contrast, the State Hospital at Rusk, Texas, insures maximum security for all criminally insane patients by housing them in buildings completely surrounded by two "escape proof" reinforced fences topped by electrically charged wires and under constant armed guard. As a security factor the gates are operated from one of the guard towers and a special alarm system may be activated by ward attendants in case of riot or attempted escape. The "usual" hospital atmosphere is provided for noncriminal patients in other buildings located only a few yards away.

Purpose

The primary purpose of this study was to evaluate selected practices in the institutional treatment of the criminally insane, as carried out in various state hospitals and prisons on July 1, 1955, and to determine which practices should be continued or expanded and which practices should be modified or eliminated.

Methodology

Following the selection and approval of the study for a doctoral thesis the writer visited eight state hospitals and three federal and four state penal institutions for the following purposes:

(a) to inspect and compare the facilities provided for the treatment of the criminally insane in penal institutions and state hospitals;

(b) to obtain the opinions of persons experienced in the institutional treatment of the criminally insane; and

(c) to test and improve the questionnaires to be used in the study.

Questionnaires were mailed to the superintendents of the 217 state hospitals in the United States. The following was requested: (a) the number and some of the characteristics of criminally insane patients in each hospital and the types of custody and treatment provided for them on July 1, 1955; and (b) the opinions of the superintendents of state hospitals concerning the types of custody and treatment they believed would be the most satisfactory for the criminally insane.

The requested factual information was received from seventy-one of the seventy-five state hospitals believed to house criminally insane patients. Seventy-two superintendents completed and returned the opinion questionnaires. All of the superintendents had the M. D. Degree and seventy of them were members of the American Psychiatric Association. The superintendents reported an average of 20.2 years experience in the institutional treatment of the mentally ill.

Each superintendent was asked to list the prisons in his state which housed criminally insane inmates. Questionnaires were mailed to each of these prisons.

A comparison was made between (a) the opinions of superintendents of state hospitals and (b) the practices in state hospitals and prisons. It was assumed that this comparison would be a useful basis for evaluating some of the positive and negative factors of the practices under consideration.

Definition of Terms

Criminally insane.--The criminally insane (for the purposes of this study) included all patients in state hospitals and all inmates of prisons who were legally classified as insane on July 1, 1955 and also:

(a) had been convicted of a felony,

(b) were awaiting trial for a felony,

(c) or were charged with a felony but considered to be insane at the time of the act or at the time of the trial and were exempt from trial or punishment by reason of insanity.

Maximum security.--"Escape-proof" wards surrounded by a wall or fence.

Medium security.--Wards under constant supervision but not surrounded by a wall or fence.

Minimum security.--Wards from which the patients were permitted to leave occasionally, with some freedom to "move about" on the hospital grounds and/or farms.

Findings

1. Do criminally insane and noncriminal patients in state hospitals need essentially the same types of custody and treatment?

A large majority of the superintendents indicated an affirmative answer to the above question. Only five of the superintendents (8.6 percent) reported that in their opinions all of the criminally insane patients of state hospitals are more dangerous and are more apt to attempt to escape than average noncriminal patients. Only nine of the superintendents (12.7 percent) believed there should be essential differences in the medical and psychiatric treatment provided for criminal and noncriminal patients. Only seventeen of the superintendents (25.7 percent) expressed the opinion that marked differences should exist in the methods of discipline which should be administered to patients in these two groups.

2. What types of housing are recommended for criminally insane patients in state hospitals?

According to the superintendents of state hospitals, the most ideal type of housing for criminally insane patients is in separate buildings. The second recommended type of housing is in the hospital wards and rooms with noncriminal patients.

The superintendents indicated that unsatisfactory types of housing for the criminally insane in state hospitals are (a) in wards or rooms separate from all other patients, and (b) in special wards for the criminally insane and sex offenders.

3. Should the criminally insane be housed in maximum, medium, or minimum security?

The superintendents were in general agreement that the type of security should not be determined by the legal classification "criminally insane" but by the individual needs of each patient. In most instances all three types of security should be available for the criminally insane, with the greater percent housed in maximum security.[1]

4. Should the criminally insane be housed in state hospitals, in prisons, or in both of these institutions?

Fifty-two of the superintendents (72.2 percent) indicated that they believed that, under ideal conditions, all of the criminally insane should be housed in state hospitals. Twenty of the superintendents (27.8 percent) were of the opinion that some of the criminally insane should be housed in prisons. Six of the superintendents submitted written statements to indicate a "strong" conviction that prisons have many advantages over hospitals, particularly for inmates in need of maximum security.

The above data show conflict in the opinions of the superintendents and the need for additional research to determine which institutions are more satisfactory for housing the criminally insane.

5. From a comparison of the number of the criminally insane in state hospitals and prisons in 1924 and 1955, what are the trends?

During the past thirty years there has been an increase of one percent in the total number of the criminally insane housed in penal institutions.

Data obtained for this study show that on July 1, 1955, seventy-one state hospitals and five penal institutions housed a total of 13,160 criminally insane.[2] Only 353 of these persons (2.7 percent) were housed in prisons.

Harms reported that in 1924 sixty-one state hospitals and three penal institutions housed 7,686 criminally insane, and only 132 of these persons (1.7 percent) were housed in prisons.[3]

6. What basic procedures are recommended for the determination of the types of custody and treatment needed for the rehabilitation of the criminally insane?

Leaders in research in the field of human behavior have recommended that treatment for all mentally ill persons should be based upon individual needs rather than the legal classification criminally insane or noncriminal. The specific needs for treatment of each patient should be determined by his personality characteristics as indicated by medical, psychiatric, and social investigation.

The superintendents of state hospitals, who completed the opinion questionnaires, were in essential agreement with the above indicated philosophy. Their opinions were sometimes in conflict in regard to the best means of carrying out this philosophy.

7. Will changes in penal administration increase the desirability of housing some of the criminally insane in prisons?

An increasing number of prisons are initiating intensive programs of treatment for emotionally disturbed inmates. Medical, psychiatric, and social services similar to those provided in state hospitals are made available. It seems reasonable to assume that prisons making these changes may be able to provide satisfactory treatment for some of the criminally insane.

8. What percent of the criminally insane patients in state hospitals, on July 1, 1955, were guilty of or were awaiting trial for murder.

Information on the above question was provided by fifty-one state hospitals. Of the 6,578 criminally insane patients reported, only 1,261 (19.2 percent) were classified as guilty of or awaiting trial for murder.

9. On July 1, 1955, what types of security were provided for criminally insane patients in state hospitals?

Sixty-three state hospitals reported a total of 12,173 criminally insane patients with 4,811 patients (39.9 percent) housed in maximum security, 6,213 patients (51 percent) housed in medium security, and 1,159 patients (9.5 percent) housed in minimum security.

In general, hospitals housing 100 or more criminally insane patients made use of maximum security and hospitals with less than 100 criminally insane used medium or minimum security.

Practices Which Should be Continued or Expanded

The following recommendations are based upon the assumption that institutional treatment for the criminally insane would be improved if greater similarity is achieved between current practices and the practices recommended by the superintendents who completed the opinion questionnaires for this study:

1. Additional state hospitals should house all of their criminally insane in separate buildings.

While 58.8 percent of the superintendents recommended that all of the criminally insane in state hospitals be housed in separate buildings, only 15.2 percent of the sixty-six hospitals reporting this information housed all of these patients in separate buildings.

2. Additional state hospitals should transfer some of their criminally insane to state prisons.

While twenty superintendents (27.8 percent) recommended that, under ideal conditions, some criminally insane patients should be housed in penal institutions, it was a general policy in only three state hospitals (4.8 percent of the seventy-one state hospitals reporting this information) to transfer some criminally insane patients to prisons for custody.

3. Additional state hospitals should house some of their criminally insane patients in maximum security.

While 80 percent of the superintendents stated that under ideal conditions some of the criminally insane in state hospitals should be housed in maximum security, only 36.4 percent of the sixty-six hospitals reporting housed some of their criminally insane in maximum security.

4. Hospitals housing all of their criminally insane in medium security should provide other types of security for some of these patients.

While 27 percent of the hospitals reporting housed all of their criminally insane in medium security, only 4.6 percent of the superintendents recommended that all of the criminally insane should be housed in medium security.

5. Institutions should continue to provide similar medical and psychiatric treatment for criminally insane and noncriminal patients.

The superintendents were in general agreement that essentially the same medical and psychiatric treatment should be provided for criminally insane and noncriminal patients, with treatment based upon individual needs. Only one state hospital indicated different treatment was provided for some of their criminally insane patients, based upon their legal classification.

6. Similar methods of discipline should be provided for criminally insane and noncriminal patients.

Sixty-four of the sixty-six state hospitals provided essentially the same methods of discipline for both criminally insane and noncriminal patients.[4] This was in general agreement with the recommendations of the superintendents of state hospitals.

Practices Which Should be Modified or Eliminated

1. State hospitals housing all criminally insane patients in maximum security should evaluate their programs and consider housing some of these patients in medium and minimum security. Data obtained for this study indicate that not all patients legally classified as criminally insane are in need of maximum security.[5]

Suggestions for Future Research

1. It is recommended that a study be made of the opinions of a selected group of state legislators to determine their understanding of the personality characteristics of criminally insane and noncriminal patients of state hospitals. It is assumed that the majority of the legislators would consider the criminally insane to be more dangerous and greater escape risks than average noncriminal patients. This assumption should be tested. The findings of the study would be the basis for an educational program to improve the understanding of state legislators concerning the characteristics of criminally insane and noncriminal patients.

2. Further study should be made of the positive and negative factors concerned with housing the criminally insane (a) in separate buildings, or (b) in the wards with noncriminal patients.

Data from this study show that the majority of the superintendents (58.8 percent) believed that under ideal conditions all of the criminally insane should be housed in separate buildings. A minority of the superintendents gave "strong" reasons for housing many of these patients in the wards with noncriminal patients and providing treatment based upon individual needs. These diverse opinions indicate the need for additional information on this problem.

3. Case studies of selected criminally insane patients of state hospitals should be made. The data obtained would be a useful basis for the determination of the types of custody and treatment needed for their rehabilitation.

247 pages. $3.20. Mic 57-1451

1. Twenty-one superintendents (32.3 percent) indicated that all of the criminally insane should be housed in maximum security and three superintendents (4.6 percent) that all of these patients should be housed in medium security. Only one superintendent (1.5 percent) stated that, in his opinion, all of the criminally insane should be housed in minimum security.

2. The penal institutions include the Medical Center for Federal Prisoners, at Springfield, Missouri, and state prisons in Colorado, Nevada, Iowa and Washington.

3. Mary Harms, "Institutional Care of the Criminal Insane in the United States," Mental Hygiene, XV (January, 1931), p. 140.

4. One state hospital provided special uniforms for the criminally insane and one hospital required the approval of a district court judge before granting ground privileges to the criminally insane.

5. Seven of the sixty-three state hospitals reporting this information housed all of their criminally insane patients in maximum security, on July 1, 1955.

SITUATIONS OF AGING IN AMERICAN SOCIETY (VOLUMES I AND II)

(Publication No. 20,418)

Martin U. Martel, Ph.D.
Cornell University, 1956

In this thesis the attempt is made to apply the pattern variable typology of societies, as formulated by Talcott Parsons in The Social System, to the analysis of the situations confronting older persons in contemporary American society. The guiding assumption of the analysis is that American society approximates the characteristics of what Parsons calls the "universalistic-achievement oriented" societal type, and that situations of aging in the society can be partially explained in terms of the general characteristics of this type.

The thesis is divided into two main parts. In Part I Parsons' theoretical frame of reference is summarized in postulate form with some modifications, and the characteristics of four basic types of societies are outlined. Following this, the implications of each societal type for the roles of aged persons within a society are indicated.

In Part II the correspondence is evaluated between the typical roles of older persons in America and those expected in each societal type. The analysis is focused on three main aspects of the total situations of older persons: 1) their occupational roles; 2) their family roles; and 3) their patterns of financial support. For each topic, the attempt is made to estimate the preferences within the society between alternative role patterns which are differentially compatible with the respective societal types. Separate analyses are presented of the roles upheld for older persons by adults on the one hand and by older persons themselves on the other, drawing upon a wide range of data. Principal reference is made to unpublished findings from the Cornell Old Age Surveys, supplemented by data from a survey conducted by the writer and information from other published sources.

From the data reviewed, a fairly close correspondence to the characteristics of the universalistic-achievement type is indicated at the most important points where estimates of correspondence were possible. At the same time, significant departures from the characteristics of each of the other types are apparent. The following findings are considered most crucial in this connection: 1) Continued occupational participation appears to be widely preferred to retirement for regularly employed persons who are still in good health. This preference is apparent in the orientations of both adults and older persons. 2) It appears to be held that a man's income in later life should correspond to his past and present occupational contributions. Current earnings and savings are preferred to all alternatives as sources of financial support. For men without personal means of support, some financial aid is approved, but the granting of sufficient income to permit the purchase of unearned luxuries is widely opposed. 3) In the preferred pattern, older parents are supposed to live apart from their adult offspring, especially when both the parents and offspring are married. Joint residence by parents and grown children is rejected as an ideal in the society, and the pattern appears to be generally opposed under conditions where it would interfere with the occupational opportunities of the offspring.

In the concluding chapters, some modifications of Parsons' societal typology are suggested, and further applications of the typology to American situations of aging are indicated. 795 pages. $10.05. Mic 57-1452

THE ROLE, STATUS AND PARTICIPATION OF THE AGED IN A SMALL COMMUNITY

(Publication No. 20,757)

Jack Smith McCrary, Ph.D.
Washington University, 1956

Chairman: Dr. Stuart A. Queen

This thesis is a study of the role, status, and participation of the aged in the small mid-western community of Coaldale. It was undertaken for the purposes of acquiring information concerning the participation of the older person in the ongoing life of the small community.

The two most significant sources of data for the study centered around the use of the informal interview and a revised form of the Cavan Activities and Attitudes Schedule, covering topics of health, family, friends, leisure and recreation, clubs and organizations, employment and economic security, religion, early life, and attitudes. The informal interview explored the oldster's feelings and attitudes about himself, his friends, and his present role, status and participation in community life. Responses were recorded verbatim, furnishing a rich quality of case history material. The findings of the study are as follows:

(1) The older person feels isolated and alone despite frequent participation with family members. He feels that he is neglected because he is old and that he is not a significant part of the family life of his children.

(2) The older person feels alone and apart from others in the day-to-day informal interaction with friends and neighbors. The oldster withdraws further and further into himself. The interaction in which he does engage is essentially meaningless, impersonal and devoid of emotional relatedness.

(3) The older person has an excess of free time in which he tends to "sit and think". When he does engage in leisure time activities, they are of a sedentary nature which removes him from association with others. He possesses few if any hobbies and manifests an inability to plan for the future. Despair, hopelessness, and a surrounding psychological atmosphere of lethargy is characteristic of his leisure time activities.

(4) He belongs to relatively few clubs and organizations and is seldom an office holder. His participation is infrequent, and the clubs and organizations to which he does belong are those which have a relatively low prestige compared to clubs and organizations from which he is excluded. Lack of participation contributes to his feeling that he is unimportant, rejected, and ridiculed.

(5) Retirement is a major crisis in the life of the older Coaldalite.

(6) Religion and religious participation provides the older person with feelings of satisfaction and security.

(7) The older person occupies a relatively low age status category in comparison with persons of younger ages. The specific community roles are ill defined, with the exception of the general feeling that the oldster should not participate too extensively in employment, clubs and organizations, nor interfere in family affairs. The desired roles dictate association with other old people, participation in religious activities, and a gradual withdrawal from community activities.

In a certain measure the findings are unique to the Coaldale community, however, in another measure they are representative of the types of feelings, participation, and attitudes characteristic of the aged in small communities throughout the United States.

402 pages. $5.15. Mic 57-1453

ROLE CONCEPTIONS OF LUTHERAN MINISTERS IN THE ST. LOUIS AREA

(Publication No. 20,761)

Richard Edwin Sommerfeld, Ph.D.
Washington University, 1957

Chairman: Dr. Ralph Patrick

Because of its importance in the structure and function of society, social scientists have long been interested in the study of religion as a social phenomenon. Toward this end considerable effort has been put forth. However, much less social research has been done on the professional functionaries of religion--the clergy.

This study is an attempt at documenting the role conception of a sample of ministers of The Lutheran Church - Missouri Synod. Sixty-five Lutheran ministers in St. Louis and St. Louis County parishes were interviewed through an open-ended interview schedule toward determining their role conceptions. The resulting conception, along with variations received, was then compared with the "official" conception as set forth in the officially recognized documents of The Lutheran Church - Missouri Synod.

Some of the conclusions coming from an analysis of the data are as follows. Within the Lutheran Church preaching is regarded as one of the major means of bringing the message of salvation to hearers, and Lutheran ministers definitely conceive of their preaching function in terms of this supernatural, authority-of-Scripture frame of reference. As a preacher the minister is the congregationally-recognized "man of God" and "ambassador of Christ," with all the authority that those titles imply. In contrast to their sharply conceived preaching role, Lutheran ministers are confused about their role as conductors of the liturgical portions of the worship service.

In keeping with the official view, Lutheran ministers conceive of themselves as the key figures in the parishes' religious education programs. In this connection they feel they have the authority to pass judgment on the religious educational attainment of prospective communicant members, but for diplomatic reasons they frequently defer exercising this "right."

The Lutheran minister does not usually counsel persons within a formal program of counseling, but when asked he gives direct counsel and advice without hesitation. However, both the problem areas he will accept and the counsel he gives are strongly within a supernatural and spiritual framework. In his counseling the Lutheran minister becomes something of a "father confessor."

Disciplinary action in religious matters is usually initiated by the minister on the basis of a norm held and accepted by the entire congregation. The minister interprets and applies the norm, and recommends patterns of action, but the actual discipline is carried out by the congregation. In this respect, church discipline is congregationally oriented, though the minister is the behind-the-scenes director.

Lutheran ministers regard parish administration as a necessary but unpleasant part of their duties. They prefer to conceive of their role in a much more spiritual and supernatural framework.

The interview data indicate that Lutheran ministers operate mostly as separate and distinct ministers in separate and distinct parishes, in spite of geographic proximity and synodical organization. Cooperative effort and mutual exchange of thought and ideas are little practiced. The Lutheran view of the complete autonomy of the local parish makes this conception possible, and Lutheran ministers seem to have built their role conception on highly provincial individualism. 271 pages. $3.50. Mic 57-1454

CLASS FERTILITY TRENDS IN WESTERN NATIONS

(Publication No. 20,067)

Dennis Hume Wrong, Ph.D.
Columbia University, 1956

Changes in trends and patterns of differential fertility need to be studied systematically and comparatively if we are fully to understand the demographic transition undergone by the countries of Western Civilization. Class fertility differentials are of major importance in Western nations, so the present study deals primarily with class differences rather than with other group differences. Methods of measuring fertility are reviewed and cumulative birth rates for successive cohorts of women derived from fertility censuses are selected as the best measures in studying trends.

Trends and patterns of differential fertility in non-industrial societies and before the decline of the Western birth rate are summarized. The widespread and long-standing existence of an inverse relation between fertility and socioeconomic status is indicated, although it has often been maintained by other means than intra-marital birth control, the chief means in modern times.

Trends and patterns in class fertility differentials in Great Britain from 1850 to 1950 are analyzed using data from fertility censuses in 1911, 1946, and 1951 as well as several studies of current socioeconomic differentials made between 1920 and 1940. Occupational class cohorts of completed fertility are derived from the censuses to permit determination of trends. Narrowing class differentials and partial reversal of the inverse relation are indicated since the late 1920's. One study of class differences in birth control usage and the findings of the 1946 Family Census on class differences in age at marriage and birth-spacing are summarized.

American fertility censuses of 1910 and 1940 are analyzed and compared with British trends. Comparable occupational class cohorts of completed fertility are derived from the American data. Numerous American studies of current socioeconomic fertility differentials between 1920 and 1940, microscopic differentials, and studies of class differences since 1940 are reviewed. Narrowing of class differences and modification of the inverse fertility-status relation are indicated although to a lesser extent than in Great Britain. One major American study of class differences in birth control is summarized and the need for further research in the sociology of fertility is emphasized.

Norwegian and Swedish data on variations in fertility by income and occupation are reviewed and analyzed for the light they throw on trends in differential fertility, microscopic fertility differences, and birth-spacing. The data suggest the virtual disappearance of the traditional pattern of differential fertility in the two countries.

Data on occupational and industrial fertility differentials

in the French family censuses of 1906, 1911, 1926, 1936, and 1946 are reviewed for evidence of trends. French occupational differentials appear to have remained remarkably stable in the present century. Secondary sources on rural-urban, intra-urban, income, and occupational fertility differences in France, Germany, and Switzerland are summarized.

Occupational cohort data from the Australian censuses of 1911 and 1921 are analyzed. Very scanty data on occupational and income differences in recent censuses are reviewed. The rich cross-sectional data on all types of differential fertility in the 1941 Canadian census are summarized. Both countries lag behind Western Europe in departing from the inverse fertility-status relation.

The final chapter groups the evidence from the nations covered by the study into three main historical periods in each of which class fertility trends and patterns broadly differed. National differences in trends and patterns are fully noted. The "immediate causes" or "means" creating and perpetuating fertility differences in each period are described. In conclusion, the implications for differential fertility of changes in mobility rates and in the height of class structures in the Western world are discussed and it is hypothesized that class fertility differences are destined to disappear as a demographic feature of "advanced" urban-industrial societies.

312 pages. $4.00. Mic 57-1455

SPEECH — THEATER

THE DRAMATIC STRUCTURE OF THE PLAYS OF EUGENE O'NEILL

(Publication No. 20,441)

William Jennings Adams, Ph.D.
Stanford University, 1957

Although Eugene O'Neill's genius is generally acknowledged, few critics agree on the nature of his contribution. To complicate the problem, much of their criticism is more concerned with O'Neill, the thinker, than with O'Neill, the dramatist. The creation of a dramatist, however, cannot be understood properly apart from its structure, for a drama's organization determines its unique form, its special emotional effects, and its total significance. The purpose of this work, therefore, is to demonstrate more accurately O'Neill's intention and achievement in each play by a careful analysis of his successive dramatic structures.

The investigation is based on the belief that the materials of a dramatic structure are artificial, and that they are consciously organized into an action which falls into three qualitative parts having specific functions. It is with the construction of these parts that the analyses are primarily concerned. Each of O'Neill's thirty-two "authorized" plays is discussed under one of the following divisions: (1) the one-act structure, (2) the normal full-length structure, and (3) the novel structure. This order corresponds almost exactly to the chronology of O'Neill's composition, and is a convenient way of observing his development.

While this approach primarily clarifies each play as a separate work of art, certain general conclusions result. It becomes apparent that O'Neill's basic use of structure, despite unusual techniques such as the employment of masks and extended asides, is firmly in the tradition of great drama. In his best work, the three parts of each structure comprise an action which demonstrates a core-meaning by a cause-effect arrangement of materials determined by a chosen form. By this accomplishment, and despite certain individual weaknesses, eight of O'Neill's plays (Ile, The Emperor Jones, Anna Christie, Desire Under the Elms, Strange Interlude, Mourning Becomes Electra, Ah, Wilderness!, The Iceman Cometh, and Long Day's Journey into Night) represent a sizable body of successful dramatic structures.

The remaining twenty-four plays reveal three major types of structural flaws. First, unity is occasionally destroyed by the presence of double, and even triple, actions within a single play. In addition, the plays are frequently diffused because the stories are started at too early a point for the actions to be represented, because the core-meanings are made too explicit, and because O'Neill's materials are generally over-developed. Finally, the diction of these plays is frequently inadequate because O'Neill attempts to substitute his stage directions and devices of spectacle for verbal expression, or attempts to achieve emotional power by writing literary speeches in a verbose, pretentious manner.

O'Neill's repetition of themes and violent subjects is appropriate to his interest in the tragic form, but such reiteration emphasizes that although he progressed from the one-act play to the full-length structure to the gargantuan opus, there is almost no other evolution in his development. Underlying all of these plays is the effort to affirm the worth of man's struggle in the traditional tragic sense, but O'Neill's basic honesty forces him to picture his characters as being without free will on an ethical level. Robbed of crucial decision by which man shares responsibility for his own fate, O'Neill's tragedy presents intense but pathetic characters who meet their various dooms without real guilt. Paradoxically, viewing life as a painful episode without cosmic significance is at variance with O'Neill's stated intention. Hence, O'Neill's dramatic aim is higher than his achievement, but his integrity is never compromised for the chance of an easy success.

402 pages. $5.15. Mic 57-1456

THE THEATRE'S ANTI-SELF: A STUDY OF THE SYMBOLISM OF YEATS' UNPOPULAR PLAYS

(Publication No. 20,452)

Robert Henry Hethmon, Jr., Ph.D.
Stanford University, 1957

Yeats' later plays have received scant attention in comparison to that bestowed on his poetry. This lack of interest in a major body of drama is attributable principally to a general lack of understanding of Yeats' meaning in the plays. It is supposed that a detailed discussion of the obscurities in these plays is the proper step to be taken at the present in order to secure an eventual appreciation and judgment of their quality as dramatic literature.

The plays are significant for expressing a religio-tragic point-of-view by poetic and dramatic means.

The meaning of the plays can be best understood if it is realized that Yeats envisioned their performance solely for a closed audience, limited by the prerequisites of high culture and spiritual awareness. The plays, in their sum, are to function as the symbolic ritual of what is -- de facto -- a secret religious society.

In the plays Yeats employs a broad symbolism, drawn not merely from classical and Christian sources, but from personal experience, contemporary life, and -- most important -- an esoteric, occult tradition. To a considerable extent the symbolism of the plays receives its coherence from reference to Yeats' A Vision (1925 and 1937). However, it must be constantly kept in mind that the elaborate symbolism employed by Yeats is not to be taken literally but rather is a body of reference which enables him to portray certain fundamental religious beliefs and problems. Yeats bases the plays on certain postulates: (1) the universe is to be understood as inevitably dualistic, and therefore, unreal; (2) unity and reality exist solely in God; (3) the soul is immortal, and, after a series of rebirths, returns evantually to God; (4) all human life, from individual to civilization, is characterized by a cyclical existence.

The plays embody what Yeats considered the most fundamental of all conflicts or antitheses, that between the reality of God and the unreality of man, between divine and human freedom, between God's freedom and man's necessity. History displays this conflict most powerfully and most poignantly at those moments when one cycle of civilization ends and another begins. Thus, Yeats translated Sophocles' plays about Oedipus (the birth of Greece), wrote two plays about the birth of Christianity ("Calvary" and "The Resurrection") and three plays about what he considered the impending crisis of our civilization (The Herne's Egg, "Purgatory," and "The Death of Cuchulain"). In "The King of the Great Clock Tower" and "A Full Moon in March" he portrayed the archetypal drama of mother goddess and dying god, and in "The Words upon the Window-pane" he contrasted the present with the Renaissance, the climax of our civilization. In almost every case Ireland is considered as the microcosm which can reflect the macrocosmic action of the rise and fall of civilizations.

The result of Yeats' long struggle to dramatize this conception of human history is his successful achievement in the last plays of a genuinely tragic outlook on man's struggle in a dualistic, cyclical universe.

519 pages. $6.60. Mic 57-1457

CHANGING PATTERN OF SPECTACLE ON THE NEW YORK STAGE (1850-1890) (PARTS ONE-THREE)

(Publication No. 19,954)

George B. Oliver, Ph.D.
The Pennsylvania State University, 1956

This work is an investigation of the many faceted character of spectacle production on the New York City stage from 1850 to 1890, covering the embryonic stages of development, through its growth to maturity and theatrical dominance, to its decline. And, though not primarily concerned with the contribution of any individual, this study indicates the indebtedness of theatre today to the stage practices, conventions, and devices used by innumerable imaginative technical artists, directors, and producers of spectacle, virtually all of whom are unknown today, but many of whom deserve a place of distinction in our theatre annals.

Spectacle, sometimes referred to as extravaganza, is defined as a legitimate stage form which appealed primarily to the aesthetic sense through the media of scene painting and construction, costume, dance, music, properties, lighting, sound effects and mass grouping. Actor and script are relegated to a subordinate role; director and technical artists dominate.

Spectacle is divided into types, such as Romantic, Fairy, Burlesque, Military or Nautical, Equestrian, or a combination of these terms. It spawned several fringe types, among them the "Combination" and the "Realistic Melodrama," and influenced Variety and Vaudeville to some extent. Such extravaganzas as the Ziegfeld Follies, the George White Scandals and the Earl Carroll Vanities stemmed from nineteenth century spectacle.

The major productions forming the bulk of this work always required eight or more lavish settings, usually with heavy machinery to change scenes. They always used resplendent costumes, properties and appointments, and the casts ranged from about fifty to over six-hundred. Illusory effects and rapid scene changes were always employed, usually in full view of astonished spectators. Music was always used, either in the play or in accompaniment to certain action. In most cases a complete orchestral score, with lyrics, was composed. Several ballets were usually performed, often with chorus accompaniment. The services of at least two leading scenic artists were always required. Processionals, marches or military drills were an invariable element. The productions usually employed several transformation scenes and tableaux, the play being climaxed with one or the other more lavish and more intricate than the rest.

Occasionally, managers added such novelties to the format of these pieces as wild animals, acrobats, magicians, or jugglers, but never to the extent of destroying the final impression of transcendent beauty. As time passed, new plots, or more accurately, scenari, were dreamed up that were ideally suited to the demands of spectacle. It is with the multiplicity of these changes that this study is primarily concerned.

The majority of theatre managers depended upon spectacle as a regular feature of their production schedule, and the spontaneous and unequivocal acceptance of these vehicles, by audiences and critics alike, ushered in the

era of the long run. More spectacles achieved over one-hundred consecutive performances than any other stage form in the nineteenth century. And no other type of play even approached the records established by many spectacles. In every case, the success of these ventures must be attributed to the technical artists.

VITA

George B. Oliver was born April 1, 1919, Chicago. Attended West Virginia State College in 1937; received A.B. in History in 1941. Newspaper reporter prior to entering Air Force in 1942. From 1945 to 1950, associated with Jose Ferrer Productions as actor and play reader; meanwhile studying for M.A. in Dramatic Art Education at New York University. Degree granted, 1950. Taught English and Speech, Maryland State College, 1950 to 1952. Entered The Pennsylvania State University in 1952 as graduate assistant in Department of Theatre Arts. Received John Hay Whitney Foundation fellowship in 1954 for this study. Received the Doctor of Philosophy degree at The Pennsylvania State University in 1956.

351 pages. $4.50. Mic 57-1458

AUDITORY SENSITIVITY AND SPEECH DEFECTS—A COMPARATIVE STUDY OF THE INCIDENCE OF SELECTED FACTORS OF AUDITORY SENSITIVITY AND DEFECTS OF VOICE AND ARTICULATION

(Publication No. 17,672)

Andrew Woodson Shook, Ph.D.
New York University, 1956

The purpose of this study was to ascertain and compare several aspects of audition and speech in a relatively large group of college students. Specifically, the investigator proposed (1) to measure four selected factors of audition: namely, acuity for pure tones, discrimination of non-symbolic sounds, discrimination of speech sounds, and tonal memory; (2) to test the subject's speech for acoustic anomalies; and (3) to compare the findings in these five areas.

All testing (with the exception of individual audiometric testing) was done under classroom conditions with groups of thirty. The 346 subjects used in this study were students enrolled in the basic speech course required by the School of Education of New York University.

Each item of the test results (raw scores--grouped when necessary) for each of the subjects, was coded and punched into IBM Cards. From the tabulations provided by the IBM Sorter and Counter, coefficients of correlation and biserial correlations were effected.

Auditory Acuity was determined by audiometric testing.

Non-symbolic Sound Discrimination and Tonal Memory were determined by means of the "Seashore Measures of Musical Talents - Series A."

Speech Sound Discrimination was determined with the Harvard Psycho-Acoustic Laboratory PB Lists (administered at 80, 60, and 40 decibels). Data from these tests was tabulated as follows: number of words and number of sounds right for each PB List, the speech sounds being placed in groups according to acoustic characteristics.

Defects of Voice and Articulation were tabulated so as to provide opportunity to compare these defects statistically with results of Non-Symbolic Tests and Speech Sound Discrimination Tests.

Comparison of Auditory Acuity with other factors of Auditory Sensitivity and with incidence of Defects of Voice and Articulation, showed no significant relationships except for the subjects classed as "Binaural Hearing Loss Group." This group of eleven subjects showed consistent differences from those with unimpaired auditory acuity (1) in speech sound discrimination capacity at 60 and 40 decibels of loudness and (2) incidence of defects of voice and articulation.

Comparison of scores of Non-Symbolic Sound Discrimination and of other factors investigated revealed some significant (though low) positive correlations with Speech Sound Discrimination and Defects of Voice and Articulation.

Comparisons of Tonal Memory capacity and other factors investigated in this study showed a significant positive correlation only with certain types of Voice Defects.

Speech Sound Discrimination scores conformed closely to the Standard Articulation Curve and demonstrated low order correlation with certain types of Voice and Articulation Defects.

Speech Tests showed that out of every 100 subjects, 73 were found to have some type of speech defect. Defects of Articulation appeared three times as often as Defects of Voice.

The conclusions which follow can be considered only as inferences based on statistical comparisons. When the term "relationship" is used, it implies only that a coincidence of scores has been observed, the validity of which can only be established by further research.

Auditory Acuity appears to be an independent capacity when compared with other factors of Auditory Sensitivity in this study.

Capacity to discriminate between Non-Symbolic sounds appears to show little or no relationship to other factors of Auditory Sensitivity and only sporadic relationships (of low order) to incidence of certain types of speech defects.

Tonal Memory capacity appears to be independent of other factors investigated in this study except for a negative relationship (of low order) with incidence of some types of Voice Defects.

Capacity to discriminate between some types of speech sounds shows positive relationships with incidence of certain types of Defects of Voice and Articulation.

According to this study, those who have Defects of Articulation also tend to have Defects of Voice.

165 pages. $2.20. Mic 57-1459

THE PHILIPPINE PIMPLINI, POEMENIINI, RHYSSINI AND XORIDINI (HYMENOPTERA, ICHNEUMONIDAE, PIMPLINAE)

(Publication No. 20,618)

Clare R. Baltazar, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Roy D. Shenefelt

This group of parasitic Hymenoptera has no host records in the Philippines but, judging from what is known elsewhere, the majority of the species must be parasitic on wood-boring Coleoptera, some on Lepidoptera, others on spider eggs, on Sphecidae nesting in dried twigs, and possibly a very few on sawfly larvae.

The subfamily Pimplinae is composed of nine tribes, eight of which occur in the Philippines. In this study, only the four tribes mentioned in the title are reviewed. The tribal and generic names adopted are those used by Townes and Townes in the Hymenoptera Catalogue, U. S. D. A. Monograph No. 2 (1951), and Townes' revision of the genera of Poemeniini and Xoridini (1956, in press).

The genera known in the Philippines under each tribe are:

Tribe Pimplini: Scambus Hartig; Townesiella, new genus; Charitopimpla Cameron; Camptotypus Kriechbaumer; Pachymelos, new genus; Exeristes Foerster; Pimpla Fabricius; Zaglyptus Foerster; and Perithous Holmgren (with a new subgenus, Hybomischos).

Tribe Poemeniini: Cnastis Townes and Eugalta Cameron.

Tribe Rhyssini: Epirhyssa Cresson and Myllenyxis, new genus.

Tribe Xoridini: Xorides Latreille.

Only 11 species and 7 subspecies were described previously from the Philippines. Six species described from Java, Borneo and India are recorded here for the first time from the Philippines. There are now known to be 69 species and 22 subspecies in 14 genera in these four tribes in the Philippines. Of these, 3 genera, 1 subgenus, 52 species and 15 subspecies are described for the first time.

Illustrated descriptions and keys to the Philippine tribes, genera, and species of Pimplinae mentioned above are included. A map of the Philippines shows the provinces, towns and mountains where most of the collections were obtained. 207 pages. $2.70. Mic 57-1460

ACTIVITY PATTERNS AND DISTRIBUTION OF THE FISHES IN THE BUNCOMBE CREEK ARM OF LAKE TEXOMA

(Publication No. 20,570)

Virgil Eugene Dowell, Ph.D.
The University of Oklahoma, 1957

Major Professor: Carl D. Riggs

A study was made of the activity patterns and distribution of the fishes in the Buncombe Creek arm of Lake Texoma, Oklahoma, from June, 1953, to August, 1955. Gill nets were used to collect the large fishes and various types of seines were the primary means used to collect the small fishes. The gill nets were set at various depths from the surface to the bottom at 13 different netting stations extending from the mouth of the creek to the upper limits of inundation. Lifts were made twice daily.

A total of 50 species and 1 hybrid representing 30 genera and 14 families was collected. Of these, 23 species were collected in gill nets, and data are presented on the seasonal and daily activity patterns of each. The percentages of the total gill-net catch of all species which the various species contributed were: gizzard shad, 27; goldeye, 17; white bass, 14; white crappie, 10; river carpsucker, 8; all others, 24. The seasonal activity varied with the different species, but usually was highest in the spring and fall. Night netting accounted for 85 per cent of the total catch of all species. In general, species of the family Centrarchidae were less active by night and more active by day than other species, but, of these, only the bluegill (Lepomis macrochirus) and the longear sunfish (L. megalotis) were collected in greater numbers by day than by night. It seems quite certain that the low day catch can be partially attributed to the ability of the fishes to see and evade the nets.

Though data were collected on the upstream-downstream and in cove-out of cove movements of each species gill-netted, no definite trends in the direction of movement could be determined for most species.

The depth distribution was determined for 20 of the 23 species gill-netted; by months for the more abundant species, by seasons for less abundant species, and the data of all months were combined for those species poorly represented in the catch. Since nets were set at all depths in water of different depths, it was possible to plot these data on diagrams representing diagramatic cross sections of the lake in such a manner that each fish was placed at the approximate locality from which it was collected in relation to surface and bottom.

A total of 47 species (included one hybrid) was collected in seines. The upstream-downstream distribution was determined for each of these.

In addition to collecting fishes, year-around data were collected on the water temperature at all depths. It was found that during the late fall and winter months the water

temperature of Buncombe Creek is essentially uniform from top to bottom, but thermoclines may develop during the spring, summer, and early fall if there is an extended period of high temperatures and little wind. These readily disappear with increased wave action.

162 pages. $2.15. Mic 57-1461

THE TAXONOMY OF THE TRICHOPTERA OF MIDDLE AND WEST TENNESSEE

(Publication No. 20,491)

Sidney William Edwards, Ph.D.
Vanderbilt University, 1956

Supervisor: Professor James J. Friauf

Most of the studies of North American Trichoptera have been carried out in the Northern, Eastern, and far Western United States; all of the Southern states have remained practically untouched despite the fact that the fauna is rich in Trichoptera. The immature stages of Trichoptera also have been neglected in most taxonomic studies, and, at the present time, larval stages are known for only about 25 per cent of adults.

In spite of the many natural habitats suitable for Trichoptera in Tennessee, very little work has been done beyond localized collections which have been inadequate or incidental to studies in other groups. The great abundance of material in this region and the dearth of information regarding immature stages as well as adults have led to the present study of the Trichoptera of Middle and West Tennessee.

One hundred and nineteen species in fifty-one genera of fourteen families have been collected in Middle and West Tennessee. Of these, 55 species have been unreported previously in the state; 14 species have been collected in fewer than three states, usually in very restricted locales; 23 species are unreported previously from any state south of Kentucky. Artificial keys have been constructed, when possible, for all of the families, genera, and species. In many instances, especially in the developmental stages, so little information is known that the construction of keys must await further collection and rearing work.

During this investigation, five species were described as new, Agapetus avitus, A. diacanthus, Athripsodes improcerus, Setodes epicmpes, and Theliopsyche melas. Larval and pupal stages have been described for the first three of those listed. The descriptions of these species were published elsewhere but are referred to in this thesis. Previously unknown larvae of two species were reared and the adults identified. Goerita semata had been collected only at Newfound Gap, N. C., and had been described from the adult only; the larva identified heretofore as Athripsodes species A was proven to be the developmental stage of Athripsodes resurgens.

A checklist of the species of Trichoptera collected in Middle and West Tennessee is included with annotations, where possible, regarding ecology, taxonomy, range, and distribution. The area encompassed during this investigation is described from the viewpoints of geology, physiography, climate, and faunistic zonation. Various aquatic habitats are discussed, including the types of habitats, the nature of each and its effects upon the resulting fauna. The distribution and occurrence of larvae and pupae in relation to stream bottom, current speed, depth, oxygen content, pollution, and dredging is discussed, and the results of this investigation are compared to those of other workers.

Various factors affecting the occurrence and distribution of adult caddisflies, such as breeding conditions, food, and wind, are discussed in the light of the results of this study. The distribution of adult Trichoptera in Middle and West Tennessee is presented from a topographical approach. It is readily apparent that the Highland Rim and the Central Basin provinces of Tennessee are the most productive of those studied, a result of the presence of many springs and small rapid streams. It is observed that the Mississippi Alluvial Plain and the western border of the Mississippi Embayment are perhaps the poorest provinces in Tennessee in terms of caddisflies. This is due to the sluggish and silty nature of many of the streams and to the disasterous effects of dredging which is used as a matter of course in improving the drainage in these provinces.

Seasonal distribution of adults in Middle and West Tennessee is limited to the months from April to October, with emergence of most species occurring one to several weeks prior to their counterparts in the northern stages. The peak month of emergence in Tennessee is July, with considerable numbers of certain species reappearing in August and September. 248 pages. $3.20. Mic 57-1462

PITUITARY-GONAD RELATIONSHIP IN THE CHICK EMBRYO

(Publication No. 19,478)

Norman W. Vogel, Ph.D.
Indiana University, 1956

Hypophysectomy by decapitation was performed on 235 chick embryos in the second day of incubation; of this number 95 survived to the designated date of sacrifice. Along with 76 operative ("eye-cup") and 93 non-operative controls, they were observed between 14 and 18 days of incubation. Analysis of wet and dry body weights and of data derived from measurements of the third toe, clearly demonstrate that the hypophysis exerts an influence over body growth of the chick embryo during the latter portion of incubation. Whereas the dry body weights of the control groups increased an average of 237% over the four day period studied, the decapitated animals showed only a 126% rise.

The growth and histogenesis of the gonads are dependent upon the pituitary. In embryos hypophysectomized by decapitation during the second day of incubation, the gonads of both sexes examined at 14 and 18 days increased in weight at rates less than half that of the control groups and have marked histological differences from the control animals. Retardation in growth of the gonads following decapitation was somewhat greater than the retardation in general body growth over the period of late incubation studied.

For purposes of comparison to body and gonad weights, the spleen was chosen as a representative "somatic" tissue.

It was found, however, that spleens of the experimental animals increased in weight in striking disproportion to the increase in body weight. Whereas normally the increase in spleen weight was proportional to the increase in body weight, the spleens of hypophysectomized embryos increased 137% between 14 and 18 days of incubation while the comparable wet body weights increased only 71%.

Free tissue cholesterol was extracted with diethyl ether from dried gonadal and splenic tissue and concentrated sulfuric acid was added to the dried ether extract to produce a colored solution. Quantitative determinations for cholesterol were made in a Beckman spectrophotometer at 320 mu. upon this solution. Decapitation of the early embryo was followed by a decrease in the amount of free tissue cholesterol per unit weight in the gonads of both sexes and in the spleen, as compared with the normally occurring increase.

Preliminary experiments with the administration of Gonadogen (PMS), a chorionic gonadotrophin, to decapitated embryos suggests that with proper dosage levels it should be possible to produce histologically normal gonads in the absence of the pituitary. However, no modification in the free tissue cholesterol has as yet been observed following such hormone treatment. 74 pages. $2.00. Mic 57-1463

AUTHOR INDEX

DISSERTATION ABSTRACTS

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